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CORRAL BOTTOM-HAYFORK
BALLY FISHER STUDY

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FISHER STUDY

BY
Slader Buck, Curt Mullis, and Archie Mossman

Presented to U.S. Forest Service

1 February, 1983

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FINAL REPORT

Corral Bottom - Hayfork Bally Fisher Study

By

Slader Buck, Curt Mullis, Archie Mossman

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ABSTRACT

The low altitude, but steeply mountainous study area lies about 5 mi (8 km) south of Big Bar, Trinity County, California. Fishers (Martes pennanti) were life trapped, immobilized with ketamine hydrocholoride and acepromazine, radio collared and released at or near the trap site. They were relocated by using both ground and air radio-telemetry. Fishers in our study area seem to prefer old growth conifers, especially multi-species stands, with a moderate admixture of mature conifer/hardwoods. Riparian areas also seem to be important habitat for them. They avoid open areas. Adult males traveled widely during the rut but females did not. Adult males seem to limit the use of habitats by females and juveniles. Individual ranges averaged 5.5 mi^2 (14.2km^2) with adult females having the smallest ranges and adult males the largest.

ACKNOWLEDGEMENTS

The original idea for this fisher study in northwestern California was brought to our attention by Ron Garrett. He was instrumental in development of the proposal and provided advice and guidance during the study's creation and early stages.

Financial support for purchase of telemetry equipment, student assistant wages and miscellanous supplies was provided by USFS Regional Office, Region 5. Living quarters, storage and office space and vehicle costs were covered by the Forest Service at Big Bar Ranger Station and the Supervisor's Offices of Six Rivers and Shasta-Trinity National Forests. The Supervisor's Office at Six Rivers National Forest provided use of a Tektronix digitizer for determination of timber type areas. The California Department of Fish and Game provided traps, immobilization equipment, and bait. In addition, the California Department of Fish and Game Wildlife Investigations Laboratory in Sacramento aided in food habits analysis and postmortem carcass examination. Additional traps were obtained through USFWS, Division of Animal Damage Control, Eureka, California.

The following people were especially helpful during the study: Jim Gordon, Shasta-Trinity National Forest, provided enthusiastic support and valuable input for the Cooperative Agreement. We wish to thank Jack Kahl, Jim Gordon and Hugh Black for their continued assistance throughout the study and for providing additional funds for aerial telemetry and vehicle use. Personnel at the Big Bar Ranger Station, particularly Dave Wright, made support possible in several areas, notably in providing data on forest roads, use of forest maps and

vehicle use. Carrol Powell and Bill Wulf furnished valuable information on the silvicultural history of the study area. Tim Burton, CDF&G, Lewiston, helped in coordination with the CDF&G and provided miscellaneous equipment and additional telemetry flights.

Humboldt State University supplied significant support. Richard Botzler, Humboldt State University Wildlife Department, provided use of the wildlife disease lab and help with carcass examination. Dave Craigie and Jerry Allen, HSU, provided statistical advice and Robert Ensminger, HSU Physics Department, provided assistance with the radio telemetry equipment. Jean Dixon, HSU Computer Center, assisted in development of the Habitat Analysis Form.

We especially thank Pat Collins, HSU Natural Resources Computer Consultant, for his invaluable help in development of the Habitat Analysis Form, SPSS analysis of the data and in cheerfully enduring our unending series of requests for new analyses.

Roger Powell, University of North Carolina, gave helpful suggestions on immobilization and valuable insights into fisher ecology. Kurt Nelson aided in collection of telemetry data.

The HSU Foundation provided financial coordination with USFS and assistance with typing the final manuscript.

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INTRODUCTION

Little is known about the biology of the fisher (Martes pennanti) in California. Most research on fishers has been done in eastern and mid-western North America and has been primarily concerned with natural history, reproductive biology and re-introduction in those areas (de Vos 1951, 1952; Hamilton and Cook 1955; Bradle 1957; Eadie and Hamilton 1958; Benson 1959; Kebbe 1961; Morse 1961; Williams 1963; Irvine et al. 1964; Coulter 1966; Wright and Coulter 1967; Weckworth and Wright 1968; Dodds and Martell 1971; Brander and Books 1973; Dilworth 1974). Few studies have concerned themselves with habitat utilization (Clem 1977; Kelly 1977). Until recently, most studies concentrated on winter ecology and were based on snow tracking and fur returns (Rand 1944; de Vos 1951, 1952; Quick 1953; Coulter 1966). Recent developments in radio telemetry now allow detailed study of summer ecology.

Within California, little has been published on fishers since the classic "Furbearers of California" appeared in 1937 (Grinnell, J. et al. 1937). Overtrapping and habitat destruction perhaps led to reduced fisher numbers, especially during the 1920's and 1930's, and this prompted the California Department of Fish and Game (CDF&G) to close the trapping season on fishers in 1946. Recently, the fisher population has shown signs of increase within northwestern California (Yocom and McCollum 1973; T. Burton Pers. Com.).

Areas where fishers are known to exist are being proposed for logging, road building and other land use changes. A good understanding of the habitat requirements of fishers is vital if these changes are to be formulated so as to insure the protection of fisher populations.

With this in mind, in June of 1977, the U.S. Forest Service (USFS), CDF&G, and Humboldt State University (HSU) entered into a Cooperative Agreement to study habitat utilization by fishers within Trinity County, California. The basic objectives were to:

1. Determine seasonal habitat utilization by fishers within the study area.
2. Determine how fishers react to logging and associated road construction.
3. Obtain an estimate of the number of fishers in the study area.
4. Acquire basic information such as food habits, denning sites, and relationships with other carnivores, as it becomes available.
5. Incorporate the above information into management recommendations which can be used by USFS and CDF&G land managers.

STUDY AREA

The study area encompasses approximately 58 mi^2 (150 km^2) and is located about five mi (9.26 km) south of Big Bar within the Shasta-Trinity National Forest, Trinity County, California (Fig. 1). Within this area fishers were studied concurrently in two subareas: Corral Bottom (CBSA) and Hayfork Bally (HBSA). Selection of this area was based on four criteria: fishers existed there, timber types of commercial value were present, winter access was possible and the area had undergone sufficient logging and road-building to allow a study of fisher reactions to these disturbances. Trapping and snow tracking efforts were confined to these areas. When a collared fisher moved outside either subarea, its locations were recorded and the data analyzed accordingly.

Table 1 gives a description of land ownership, roads and amount of timber harvest within the study area. The two subareas are adjacent but differ most importantly in miles of roads and percent of forest harvested. Because of these differences we could learn more about fisher requirements by studying them in both areas than by concentrating our efforts in only one area.

Corral Bottom Subarea (CBSA)

Corral Bottom is a basin approximately 6.0 mi (9.7 km) long by 4.5 mi (7.2 km) wide with elevations ranging from 2,800' (853 m) at its lowest point to an average of 4,200' (1,280 m) on the surrounding ridges. Pattison Peak and Monument Peak border Corral Bottom on the

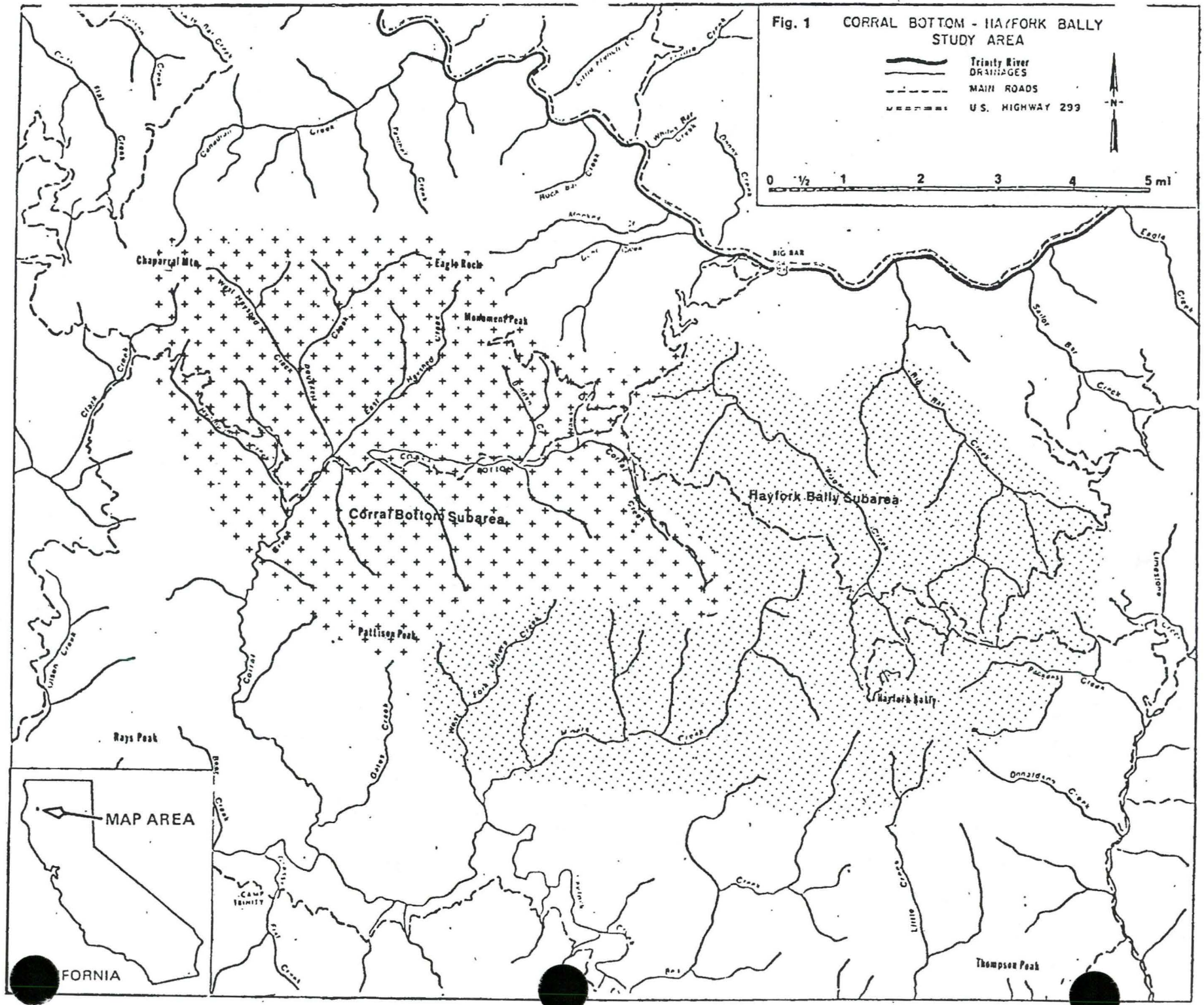
Fig. 1 CORRAL BOTTOM - HAYFORK BALLY STUDY AREA
Trinity River DRAINAGES
MAIN ROADS
U.S. HIGHWAY 299
N
0 ½ 1 2 3 4 5 mi
Chaparral Mtn.
Eagle Rock
Monument Peak
BIG BAR
Corral Bottom Subarea
Hayfork Bally Subarea
Pattison Peak
Hayfork Bally
Rays Peak
Thompson Peak
MAP AREA
FORNIA

TABLE 1

Study Area Size, Land Ownership
Roads, and Timber Harvest.

	CBSA	HBSA
Subarea Size	28 mi^2 (72.5 km^2)	30 mi^2 (77.7 km^2)
Elevation Range	5216' (1280 m) max. 2800' (853 m) min.	6273' (1915.5 m) max. 2750' (838.4 m) min.
USFS Land	80%	97%
Private Land	20%	3%
Forested[1]	~87%	~98%
Clearcut	7%	5%
Pre-Salvage Logging[2]	20 - 30%	10 - 15%
Seasonally Maintained Roads	72 mi (115.2 km)	45 mi (72 km)
Four-wheel Drive Roads	140 mi (224.0 km)	5 mi (8.0 km)
Habitat Altered By Road Construction[3]	388 acres (157 ha)	143 acres (58 ha)

1/ Includes Clearcuts
2/ Pre-salvage logging defined as harvest of timber anticipating future mortality from any cause. It is a form of select cut. These figures are our estimates because no quantitative information was available through Forest Service silvicultural records.
3/ Assumes road and berm width of 25' for seasonally maintained roads and 10' for four-wheel drive roads.

southwest and northeast respectively, and have elevations over 5,000' (1,524 m). Corral Bottom is drained by Corral Creek. Corral Creek has five main tributaries and flows westerly, bisecting Corral Bottom. Its main headwaters are in Upper Haypress Meadows on the southeastern end of this subarea.

The CBSA has undergone extensive logging and roadbuilding compared to the HBSA. USFS estimates for the period of 1979-1986 anticipated an additional 500 acres (202.3 ha) of clearcutting, and 500 acres (202.3 ha) of other types of harvest. Two or three logging operations were planned to be almost continuously in progress until at least 1986 in the Corral Bottom subarea.

Hayfork Bally Subarea (HBSA)

In 1980, the Hayfork Bally subarea (HBSA) contained mostly old growth forest and lay in the Big Bar and Hayfork Ranger Districts. (Fig. 1, Table 1). Elevation ranges from 2,750' (838.4 m) in lower Price Creek to 6,273' (1,915.5 m) on the summit of Hayfork Bally.

This subarea is drained by seven major stream systems: Price Creek, Big Bar Creek, Little Creek, Miners Creek, Bear Creek, Packers Creek and Donaldson Creek. The subarea lies directly adjacent to the CBSA and extends southward and eastward from its border.

USFS anticipated timber harvests through 1984 would include two timber sales totaling 568 acres (230 ha) and another sale with a goal of 11.2 million board ft. or about 640 acres (259 ha) at very roughly 17,500 BF/acre. No timber harvests are presently anticipated in the southwestern portion of the subarea, south of the Hayfork Divide, as this part was (in 1981) classified as RARE II land.

Vegetation

Vegetation in the two subareas is mainly coniferous forest. Areas of mixed conifer forest consisting of Douglas-fir (Pseudotsuga menziesii) and white fir (Abies concolor) in almost equal proportions with lesser amounts of ponderosa pine (Pinus ponderosa), sugar pine (Pinus lambertiana) and incense cedar (Calocedrus decurrens) occur throughout the study area.

Douglas-fir is the most common species, especially at lower elevations on north facing slopes. It occurs in equal abundance with white fir at elevations above 4,500' (1,372 m) and along creeks at lower elevations. The highest elevations and those with very moist north facing slopes support a predominately white fir forest. On high, dry southern exposures, areas of montane chaparral occur.

Southern exposures at lower elevations support forests of Douglas-fir and ponderosa pine, Douglas-fir and madrone (Arbutus menziesii) or ponderosa pine and madrone. Canyon live oak (Quercus chrysolepis) and black oak (Quercus kellogii) occur on xeric sites at elevations up to approximately 5,000' (1,524 m). Canyon live oak also occurs frequently as an understory species.

MATERIALS AND METHODS

Identical materials and methods were used in both subareas, except as noted below.

Trapping

Fishers were captured using single door National-type wire cage traps. Two trap sizes and models were used in both areas: 10 x 10 x 30" (25.4 x 25.4 x 76.2 cm) non-collapsible and 10 x 12 x 32" (25.4 x 30.5 x 81.3 cm) collapsible and non-collapsible. In addition, one 9 x 9 x 28" (22.9 x 22.9 x 71.1 cm) non-collapsible trap was used in the HBSA. Traps were placed where we thought fishers would occur, primarily near drainages, on ridges and in saddles. Traps were usually secured to a tree or downed log with 1/8" (3.2 mm) wire cable and cable clamps, then baited, covered with burlap and then covered with bark, litter or other materials found near the trapsite. Lastly, each trap was set and scented with an olfactory attractant.

During the 1977-78 trapping period nearly all traps were baited with tuna cat food and strawberry jam. During the 1978-79 trapping period tuna cat food and strawberry jam or small portions of road-killed deer (Odocoileus hemionus) were used as bait. During both trapping periods meat from several other species of road-killed mammals and birds were also used as it became available. Pre-baiting in wired open traps and call baiting with deer meat or spawned-out salmon suspended near trapsites were done to attract fishers.

Traps were checked daily for captures, sprung traps, signs of disturbances and for rescenting. When it was necessary to leave the study area during the 1977-78 trapping period we closed each trap. During the 1978-79 trapping period, traps were wired open when we left the study area. When we returned to trap we rebaited, reset and rescented each trap.

When a fisher was captured we covered the trap with a blanket to exclude light and calm the fisher, unbolted the trap from the tree or downed log and transported the fisher in the trap to a convenient location for immobilization. Captures other than fishers were immediately released.

Immobilization

Prior to immobilization an approximate fisher weight was obtained by weighing the trap and fisher with a Hanson Model 60 Dairy Scale, then subtracting the trap weight from the total weight. Traps had been previously weighed and labeled. Fishers were immobilized by placing a wooden plunger inside the trap (R. Powell Pers. Com.), pushing the fisher against the rear of the trap and injecting a mixture of ketamine hydrochloride and acepromazine into the thigh or shoulder with a hand-held syringe. Dosages of .5-8 mg/lb of ketamine hydrochloride in combination with 0.5 mg/lb acepromazine were used. If a second injection was necessary ketamine hydrochloride was administered at 0.5 mg/lb into a different injection site.

After the drugs had taken effect the fisher was removed from the trap, immediately checked for its response to immobilization and

examined for injuries that might require immediate attention. The fisher was reweighed to obtain a more exact weight and fitted with a radio collar. A series of measurements was recorded (Appendix A). Rectal temperature was taken using a baby thermometer.

Fishers were aged by palpation of the sagittal crest and inspection of dentition. Fishers with little or no sagittal crest development, minimal tooth wear and no tooth discoloration were classified as juveniles. Fishers having obvious sagittal crest development and worn teeth which may or may not have been discolored were classified as adults. Fishers estimated to be 12 months or younger were considered to be juveniles; those older were classified as adults. All fishers were ear tagged with plastic roto-tags (Nasco West, Inc., Modesto, CA) and larger fishers were lip tattooed using a domestic rabbit tattoo kit (Valentine Equipment Co., Bridgeville, IL). If the fisher had not begun to regain muscle control it was inspected for ectoparasites, then given a 0.5 cc injection of procaine penicillin to guard against infection before being placed back in the trap. Fishers were left in the trap until all noticeable effects of the drugs had worn off and then released as close as possible to the capture location.

Telemetry

Equipment

Telemetry equipment was purchased from Telonics, Inc., Mesa, AZ. We used three sizes of radio collars. During the 1977-78 trapping period, 110g collars were placed on all captured fishers. During the 1978-79 trapping period we used 110g collars for adult males and "low profile" 90g and 76g collars for females and most juvenile males. Radio collar weights refer to weight of transmitter package (transmitter, battery, canister), transmitting antenna and collar material. Excess collar material was trimmed after the collar was placed on the fisher. All transmitters broadcasted within the 159 MHz range.

Either a 10 or a 20 channel Model TTR-1 receiver combined with an RA-2 headset and a 2 element yagi antenna (Model RA-2AK) were used as receiving equipment. A hand held bidirectional DF paddle (Model RA-1AK) and 5 and 8 element yagi antennas (Model RA-4A and unknown model) failed to provide reception equal or superior to the 2 element yagi in the rugged topography of our study area.

Data Collection

After release, fishers were located by telemetry from vehicles, from fixed-wing aircraft or on foot. Vehicle telemetry was done by traveling forest roads until a signal was obtained. Then, using the null method (Beaty 1978), two to six bearings were taken at widely spaced locations until an adequate triangulation was obtained. If possible, the fisher was "circled" in order to obtain the most precise location possible. These telemetry bearings were plotted on USFS 4 in/mi maps using a Silva Ranger compass (Silva Compass Co. La Porte, IN).

Aerial telemetry was accomplished using a Cessna 180 high wing monoplane. The handle of a 2 element yagi antenna was secured parallel to each wing strut using hose clamps and electrical tape. This positioned the long axes of the antenna elements parallel to the plane's fuselage. We also taped an omnidirectional whip antenna to the lower part of the fuselage. If a fisher was not immediately located, one or two observers would scan for signals as a grid pattern was flown over the study area. After an initial signal was received, the location was pin-pointed by decreasing the volume of the receiver, lowering the altitude of the aircraft and using the signal blocking effect of topography, all in conjunction with each other.

Telemetry on foot was used to obtain visual observations and specific locations such as den/resting sites. The signal was followed until the fisher or den/resting site was located. The location of a non-moving fisher could often be determined at very close range by disconnecting the 2 element yagi and using only the small, directional, internal antenna within the receiver.

Where one person obtains the triangulation data in each radio-location, the fisher must be in about the same place when each bearing is taken. Few locations were obtained for fishers that were traveling fairly rapidly cross-county. The exceptions were when we closely followed a fisher which was moving along a riparian area or when we followed a fisher track while following a fisher. Due to surrounding topography and closeness of the investigator to the fisher, the location could be determined without a triangulation.

Snow Tracking

In addition to locations obtained from trapped individuals, telemetry, and visual observations, an effort was made to record movement patterns and habitat utilization from snow tracking. Shortly after the snow storms, roads within the study area were cruised by vehicle in search of tracks. Cross-country skis were used when snow conditions prevented vehicular use. When a track was located it was followed as far as conditions permitted. In most cases, suitable substrate was present for distances less than one eighth of a mile (201.2 m). Therefore, tracking resulted in mainly point data and total distance for all tracks was not recorded. These data were plotted on USFS 4 in/mi maps.

Individual Ranges

Individual ranges were determined by the convex polygon method (Mohr 1947). All locations were plotted on USFS 4 in/mi maps and individual ranges were calculated for all fishers that had at least four locations. A fisher location is defined as the occurence of a fisher as determined by trapping, telemetry, track observation or visual observation. If a location occurred on an ecotone, or a fisher track crossed an ecotone, a location was recorded for each timber type or plant community.

Individual ranges for three fishers in the HBSA were determined using Hayne's "center of activity" home range method (Hayne 1949). Hayne's method drastically reduced the size of the individual ranges as

determined by the convex polygon method. Consequently, we decided to use the convex polygon method, as it allowed direct comparison with many other studies and because there seemed to be no general agreement that any other method is consistently superior.

We used capture locations to help determine individual ranges if they were on the boundary but were not obviously far outside the fisher's individual range as determined by radio-telemetry. We did not include the rut wanderings of males in these calculations and females did not show these movements.

We also measured range overlaps among fishers. A range overlap is defined as concurrent use of range by two or more fishers.

Habitat Analysis

An extensive and an intensive data base were created for analysis of habitat use by fishers. The extensive data base contains 21 variables for each fisher location plotted during the study. These variables were obtained directly from USFS 4 in/mi blueline maps, timber type maps and field notes. Variables for the extensive data base are listed and defined in Appendix B.

The intensive data base contains 66 variables and included those variables in the extensive data base plus variables from field sampling at selected fisher locations. An additional 12 variables were sampled at den/rest sites. A sample Habitat Analysis Form and a key to the variables in the intensive data base are given in Appendix C.

Variables from both data bases were analyzed using the Statistical Package for the Social Sciences (SPSS) (Nie et al., 1975). Frequencies of occurrence for all variables were generated. After a preliminary review, eight variables in the extensive data base and 27 variables in the intensive data base were chosen for chi-square analyses with sex of fisher, age of fisher, date of location and time of location.

Seventy-one individual timber types occur in the CBSA and 72 occur in the HBSA. These were grouped into 11 timber type groups according to similarities in physiognomy crown size, crown cover and USFS timber type modifiers (Table 2). We then tested fisher timber type group preference or avoidance with chi-square analyses. A list of specific timber types within each timber type group and a key to the timber types are given in Appendix D.

Timber type maps were prepared by a contractor for the Shasta-Trinity National Forest in 1979 from aerial photos taken in 1975. These translucent maps were positioned over the blueline maps and the areas of the timber type polygons within each fisher's individual range were measured with a Tektronix 4956 digitizer. Digitized timber type polygon summations within indiviudal range boundries were larger than individual range measurements but differed less than 2.5 percent.

The area of timber types classfied as riparian, (i.e., those timber types designated SR or those with an SR modifier) (Appendix D), is underestimated. The timber type maps were based on aerial photographs so the understory component can usually be determined accurately only in those stands which have an open overstory. Heavy crown cover of overstory vegetation may prevent accurate identification of riparian areas. This is particularly true in drainages with steep topography

TABLE 2
Timber Type Groups.

Group No.	Title	No. Individual Timber Types Within Group[1]	Description
1	Open Areas	7	No Standing Trees - Clearcuts, Grass, Barren Areas.
2	Plantation/Brush	11	No Large Trees - Plantations, Montane Shrub, Chaparral.
3	Hardwoods	4	Live Oak, Oregon White Oak, Pacific Madrone, Mixed Commercial Hardwoods.
4	Mature Closed Conifer Forest	23	Conifer Stands With Crown Size 13-40' Crown Cover Greater Than 40% - No Hardwoods. Includes What are Commonly Referred to as Old Growth and Virgin Stands.
5	Mixed Conifer/ Hardwood Forest	17	Conifer Stands With Crown Size 6-40', Crown Cover Less Than 40% - With Hardwoods.
6	Open Conifer Forest With Shrub	17	Conifer Stands With Crown Size 6-40', Crown Cover Less Than 40%, With Shrubs Present.
7	Open Conifer Forest With Grass	7	Conifer Stands With Crown Size 13-40', Crown Cover Less Than 40% With Open Areas Between the Conifers.
8	Small Conifer/Conifer Non-commercial	9	Small Conifers With Crown Size Less Than 24', Crown Cover Greater Than 20%, Non-commercial Conifers May Be Present.

TABLE 2 (continued)
Timber Type Groups.

Group No.	Title	No. Individual Timber Types Within Group[1]	Description
9	Small Conifer/ Hardwoods	5	Small Conifers With Crown Size Less Than 12', Crown Cover Less Than 40% - Hardwoods Present.
10	Riparian Forests	3	Conifer Stands With Crown Size 13-40', Crown Cover Less Than 40% - Associated With Riparian Areas - Salix, Alnus, Corylus.
11	Unlabeled	1	Unlabeled Polygons On USFS Timber Type Maps.
TOTAL		104	

1/ See Appendix D for a listing of all individual timber types/timber type groups and a key to individual timber types.

where overstory trees are closely spaced. Furthermore, very narrow or small timber types were not mapped. Consequently, several riparian areas do not appear on the timber type maps that were used. Fisher locations were recorded from certain of these areas but were assigned to the mapped timber type.

Intensive habitat analyses were conducted between June and December, 1979. All successful trapsites, track sites, den/rest sites and visual observation sites were analyzed. Originally we intended to intensively sample all fisher locations. We began analyzing those locations which were grouped together in order to sample a maximum number in a minimum amount of time. However, as field work progressed, we realized that we could not sample all locations. Therefore, the following sampling procedure was adopted.

All telemetry locations in the HBSA within 1/8 mapped mile (0.2 km) of a driveable road (n=45) were sampled (Table 3). In the CBSA there were 130 telemetry locations within 1/8 mapped mile (0.2 km) of driveable roads and we did not have time to sample all of these. Therefore, in the CBSA all 15 locations of juveniles within 1/8 mapped mile of driveable roads were sampled and a number of adult locations equal to the number of adult locations sampled in the HBSA (n=25) were selected randomly for sampling. A random sample of ten telemetry locations of an adult female (No. 19) in Price Creek were analyzed in the HBSA. The remaining 23 locations in the intensive data base (13 from CBSA and 10 from HBSA) were those that were greater than 1/8 mapped mile from a driveable road that had been sampled as grouped locations. Because of its importance to understanding fishers, a maternal den, south of and just outside the HBSA was analyzed. It was the only positively known maternal den found during the entire study.

To check the accuracy of the timber type maps, we compared the results of our intensive analyses to the mapped timber types at the corresponding fisher locations and found them to be reasonable accurate. Thus, by using the mapped timber types we gained habitat use information from fisher locations which we did not intensively sample.

Ground radio-telemetry data were compared to air radio-telemetry data to check for bias in the ground telemetry data. Topographical interference with the radio signals makes animals more likely to be successfully located when close to the roads than when far from them. Since most roads were constructed for logging purposes it seemed likely that our ground locations would be biased toward locating fishers in or near logged areas. Air telemetry would record the animals' locations regardless of their relationships to roads. Contrary to our expectations, ground telemetry data were quite similar to air telemetry data, based on percentage of occurrence per USFS timber type. As a result, we pooled the air and ground telemetry data for our analyses.

Data collected from the CBSA at night (defined as one hour after sunset to one hour before sunrise) were compared to data collected during the day (defined as one hour after sunrise to one hour before sunset). Only CBSA data were used for this comparison because of the small sample size (n=8) of HBSA nocturnal data. Nocturnal data were found to be comparable, based on percentage of occurrence per USFS timber type to diurnal data and, as a result, were pooled for habitat analysis purposes.

TABLE 3

Telemetry Locations Within One-Eighth Mile of Driveable Forest Roads Sampled Within the Study Area.

	CBSA			HBSA		
	Total	No. Sampled	Percent	Total	No. Sampled	Percent
Adult Male	98	13	13	13	13	100
Juvenile Male	6	6	100	17	17	100
Adult Female	17	12	71	12	12	100
Juvenile Female	9	9	100	3	3	100
TOTAL	130	40	31	45	45	100

RESULTS

By all methods we recorded 254 locations in the CBSA and 184 in the HBSA.

Trapping

A summary of fishers captured in each subarea is given in Tables 4 and 5. We did not trap every month (Table 6) and did not attempt to trap fishers during the breeding and kit rearing season from late March until mid-May 1978. No animals of any species were captured when we trapped during June and July 1978. At least part of the reason for the poor success during June and July was trap disturbance by black bears (Ursus americanus); they destroyed up to 20 percent of the sets each night.

A summary of trapping data is presented in Table 7. In the CBSA the 16 captures were made at 11 trapsites, five of which had multiple captures. At trapsite No. 3 an initial capture and recapture of two adult males were made within a 24 hour period. Trapsite 24 had a juvenile male followed by a juvenile female ten days later. At trapsite 72 an adult male was followed by an adult female capture nine days later. Trapsite No. 12 had an adult female and then an adult male exactly four months later, and trapsite No. 1 had an adult male followed by a juvenile male approximately a year later.

In the HBSA, eight fishers were captured at five trapsites. A single trapsite in the Big Bar Creek drainage yielded three fishers: on 25 February 1978, an adult female, seven days later, an adult male, and

TABLE 4

Summary of Fishers Captured Within The Corral Bottom Subarea
17 November 1977 - 24 March 1979

No.	Sex	Age	Wt(lbs)/(kg)	Capture Date	Capture Location	Comments
04	F	AD	3.6/1.6	17 Nov 77	North Base of Pattison Peak	Recapture 01 Feb 78 Found Dead 11 Feb 78
05	M	AD	7.5/3.4	18 Nov 77	Corral Creek/Miners Creek Ridge	Recapture 18 Feb 78 Found Dead 7 Oct 78
06	F	JUV	3.7/1.7	19 Nov 77	Upper West Hayshed Creek	Found Dead 01 Dec 78
27	M	AD	9.0/4.0	11 Feb 78	Haypress Meadows	Found Dead 17 Feb 79
10	M	AD	7.3/3.3	08 Mar 78	Bidden Creek	Recapture 22 Mar 79 Recollared
14	M	AD	10.1/4.5	17 Mar 78	North Base of Pattison Peak	
02	M	JUV	7.0/3.2	29 Nov 78	Corral Creek/Miners Creek Ridge	Collar Recovered 9 Feb 79
01	M	JUV	7.1/3.2	09 Feb 79	Lower East Hayshed Creek	
16	M	JUV	6.0/2.7	11 Feb 79	North Slope Pattison Peak	
20	F	JUV	4.6/2.1	19 Feb 79	Lower East Hayshed Creek	
18	M	AD	10.0/4.5	15 Mar 79	Southwest Slope Monument Peak	
22	M	AD	10.1/4.5	22 Mar 79	Southwest Slope Monument Peak	
24	F	AD	3.8/1.7	24 Mar 79	Southwest Slope Monument Peak	

TABLE 5

Summary of Fishers Captured Within The Hayfork Bally Subarea
25 February 1978 - 18 March 1979

No.	Sex	Age	Wt(lbs)/(kg)	Capture Date	Capture Location	Comments
08	F	AD	4.8/2.2	25 Feb 78	Big Bar Creek	Collar Recovered 26 June 78
09	M	AD	8.1/3.6	03 Mar 78	Big Bar Creek	
11	M	JUV	6.4/2.9	18 Nov 78	North Slope Hayfork Bally	
13	M	JUV	6.6/3.0	24 Nov 78	Big Bar Creek	Recovered 22 Jan 79
15	F	JUV	4.0/1.8	18 Feb 79	Big Bar Creek	Recovered 31 March 79
17	M	JUV	6.0/2.7	10 Mar 79	Price Creek	Recapture 18 March 79 Recovered 12 May 79
19	F	AD	5.4/2.4	10 Mar 79	Price Creek	
21	M	AD	7.7/3.5	18 Mar 79	Price Creek	

TABLE 6

Monthly Live Trapping Effort Near Big Bar, California [1]

	Subarea	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Summary
1977-78	CBSA		60/3		5/0	65/3	105/2		60/0		35/0	330/8
	HBSA			2/0	12/0	36/1	18/1			18/0	45/0	131/2
1978-79	CBSA	24/0	66/1			68/3	140/4					298/8
	HBSA	38/0	32/2	11/0	24/0	13/1	50/4					168/7
TOTAL	CBSA	24/0	126/4		5/0	133/6	245/6		60/0		35/0	628/16
	HBSA	38/0	32/2	13/0	36/0	49/2	68/5			18/0	45/0	299/9
TOTAL CBSA & HBSA		62/0	158/6	13/0	41/0	182/8	313/11		60/0	18/0	80/0	927/25

[1]The results are given as trap nights per fisher captures.

TABLE 7

Summary of Trapping Data.

	CBSA		HBSA	
No. Trapsites	80		Approximately 35	
Trapping Period				
1977-78	15 Nov. - 23 July		21 Dec. -- 23 July	
1978-79	12 Oct. - 25 March		8 Oct. - 18 March	
No. Captures	Capture	Recapture	Capture	Recapture
1977-78	6	2	2	0
1978-79	7	1	6	1
TOTAL	13	3	8	1
Trapping Success	No. TN[1]	% Success[2]	No. TN %	Success
1977-78	330	2.4	131	1.5
1978-79	298	2.6	168	4.2
TOTAL	628	2.6	299	3.0
Sex Ratio	Male/Female	n[3]	Male/Female	n
1977-78	67:33	6	50:50	2
1978-79	71:29	7	67:33	6
TOTAL	69:31	13	63:37	8
Age Ratio	Adult/Juv.	n	Adult/Juv.	n
1977-78	83:17	6	100:0	2
1978-79	43:57	7	33:67	6
TOTAL	62:38	13	50:50	8
Non-Target Captures	No.	Species	No.	Species
1977-78	1	Grey Fox[4]	3	Grey Fox
	1	Dusky-Footed Woodrat[5]	1	Dusky-Footed Woodrat
1978-79	2	Grey Fox		

1/ TN is trap nights
2/ % Success = No. fishers captured/No. trapnights
3/ n is number of animals
4/ Urocyon cinereoargenteus
5/ Neotoma fuscipes

nine months after that (23 November) a juvenile male. The single recapture in the HBSA was a juvenile male initially captured on 10 March 1979 in the Price Creek drainage and recaptured on 16 March 1979 at the same capture site.

In both subareas all but one of the 25 total captures occurred within the mature closed conifer timber type group. The remaining capture occurred in the riparian forest timber type group. When successful trapsites were grouped according to actual location, 50 percent (n=8) were in riparian areas, 25 percent (n=4) were on ridges, 12.5 percent (n=2) were on saddles that separated major drainages and 12.5 percent (n=2) were on a mid-slope.

Based on catch per trapnight there was no statistical difference in the number of fishers captured in the two subareas. Even though twice as many male as female fishers were captured, the difference was not statistically significant. Also, within each subarea, sex and age ratios for each trapping period and for both trapping periods combined (1977-78 and 1978-79) were not significantly different from 50:50 (Table 7).

Fishers were calm but alert when first approached but often became active while being moved to a convenient spot for immobilization. Most fishers had pulled parts of the burlap covering into the trap but otherwise seemed to have remained calm until the trap coverings were removed to allow the trap to be moved. Only four fishers had minor scrapes or cuts, possibly incurred while attempting to escape from the trap.

Older fishers often showed evidence of past injuries and various dental anomalies. Four of seven adult males and one adult female had

chipped or missing canines and several of these animals were also missing incisors. One immature male had a docked tail (260 mm) and another had extensive swelling surrounding the lower jaw bone and poorly developed dentition, although his weight and overall health appeared to be normal. A complete description of all detected injuries for each fisher is given in the individual fisher accounts (Appendix F).

The only fisher showing external presence of porcupine (Erethizon dorsatum) quills was an adult male with a single quill in his right foreleg. Six of the 21 fishers had no noticeable ectoparasites; the remainder had light to heavy infestations of ear mites or small numbers of ticks and/or fleas.

Snow Tracking

Snow tracking during the first winter (1977-78) yielded 11 fisher tracks in the HBSA and 14 in the CBSA. The second winter (1978-79) produced more snow and colder weather. We recorded 25 fisher tracks in the HBSA and 7 in the CBSA. We recorded snow track data between 27 November 1977 and 9 April 1978, and between 13 November 1978 and 9 March 1979 in the CBSA. In the HBSA, we recorded snow track data between 21 December 1977 and 29 November 1978, and between 10 January and 18 March 1979.

In the warm winter of 1977-78, only a few rather poor tracking snows occurred. The study area received normal amounts of precipitation, but the majority was in the form of rainfall. Most storms were followed by unseasonally warm rains, which further deteriorated the tracking substrate.

We placed the timber types of track locations into timber type groups and compared percent occurrence for each subarea. These proved to be quite similar, so we will present the combined data representing the entire study area. A comparison of timber types associated with track locations to timber types associated with telemetry locations showed that 23.7% (14/59) of the track locations in the study area occured in plantations while only 3.2% (11/347) of the telemetry locations occurred within plantations. When track data were grouped according to timber type (Table 3), 32.2% (19/59) occurred in areas classified as either open or brush/shrub while only 5.2% (19/347) of telemetry locations occurred in these timber type groups.

The plantations where fisher tracks were located were characterized by thick stands of whitethorn (Ceanothus cordulatus) and manzanita (Arctostaphylos sp.) with a crown cover of greater than 80% and an average vegetation height of between 1.5 and 3.0 m. Whitethorn was often dense enough so that fishers traveled on top of snow covered plants for 30 or more feet (11 m) before returning to ground level. Fisher tracks would often crisscross areas of dense whitethorn and then follow a fairly straight course through areas of manzanita or conifer seedlings. Most tracks associated with clearcuts indicated that fishers were hunting, especially when there was sufficient snow to cover and depress the shrubby vegetation. At times, coyote (Canis latrans), bobcat (Lynx rufus) and grey fox (Urocyon cinereoargenteus) tracks as well as fisher tracks were recorded from clearcuts, all apparently hunting.

Tracks showed that fishers often investigated downed logs and brush piles and often traveled atop downed logs. On three occasions, fishers

deposited a yellowish mucus on such logs. These deposits appear to be some sort of scent mark.

Individual Ranges and Movements

A summary of location data for individual fishers is presented in Tables 8 and 9, and mean range sizes for sex and age groups are presented in Table 10. Only those ranges which we feel are accurate because of a sufficient number of useful locations (minimum of four) are used in determining average ranges. For example, two very elongate ranges are omitted because we now know that one of these animals has a much larger individual range than our earlier data indicate (C.C. Coolahan, Pers. Comm.).

Approximately 20% of the ranges of collared fishers extended beyond the study area as shown in Figure 1. However, the percentage clearcut, pre-salvage logging and miles of roads within this additional area are comparable to those in Table 1.

Average ranges for males of each subarea were larger than for females. We obtained fewer female locations over shorter periods of time than for males. However, we are reasonably confident that adult female ranges are smaller than male ranges.

For each subarea adult male ranges were larger than juvenile male ranges. In the CBSA, the individual range of the only juvenile female with sufficient number of locations (n=23) was substantially larger than the ranges of two adult females with 10 and 15 locations respectively. It was also substantially larger than the individual ranges of two adult females (n=10 and n=26) in the HBSA. We recorded only four locations of

TABLE 8

Summary of Location Data For Individual Fishers in the Corral Bottom Subarea

Fisher No.	Sex	Age	Time Period[1]	No. Locations	Individual Range[2] mi^2	Individual Range[2] km^2
04	F	AD	16 Nov 77 - 11 Feb 78	10	2.64	6.84
05	M	AD	17 Nov 77 - 7 Oct 78	50	5.00	12.95
06	F	JUV	18 Nov 77 - 12 Dec 77	3	---	---
27	M	AD	11 Feb 78 - 17 Feb 79	84	4.78	12.38
10	M	AD	08 Mar 78 - 26 June 79	16	8.48	21.96
14	M	AD	17 Mar 78 - 8 April 79	14	6.78	17.56
02	M	JUV	29 Nov 78 - 9 Feb 79	3	---	---
01	M	JUV	9 Feb 79 - 24 Feb 79	3	---	---
16	M	JUV	11 Feb 79 - 12 June 79	11	5.03	13.03
20	F	JUV	19 Feb 79 - 26 June 79	23	5.33	13.80
18	M	AD	15 Mar 79 - 26 June 79	7	4.80	12.43
24	F	AD	24 Mar 79 - 26 June 79	15	1.27	3.29
				239		

[1] Period from original capture to date of last reliable location used to determine ranges.

[2] Based on four or more trapsites, telemetry or visual observations.

TABLE 9

Summary of Location Data for Individual Fishers in the Hayfork Bally Subarea

Fisher No.	Sex	Age	Time Period[1]	No. Locations	Individual Range[2] mi^2	Individual Range[2] km^2
08	F	AD	25 Feb 78 - 12 July 78	10	0.86	2.23
09	M	AD	3 March 78 - 2 May 79	58	13.18	34.15
11	M	JUV	18 Nov 78 - 26 June 79	20	12.18	31.54
13	M	JUV	23 Nov 78 - 22 Jan 79	6	3.07	7.96
15	F	JUV	18 Feb 79 - 31 March 79	4	0.58	1.52
17	M	JUV	10 March 79 - 11 May 79	12	2.55	6.61
19	F	AD	10 March 79 - 15 Aug 79	26	1.64	4.25
21	M	AD	18 March 79 - 30 June 79	7	2.29	5.94
				143		

[1] Period from original capture to date of last reliable location used to determine ranges.

[2] Based on four or more trapsites, telemetry or visual observations.

TABLE 10

Summary of Range Data for Collared Fishers By Sex and Age.[1]

Age/Sex	Number of Locations		$\bar{x}^2$ Range Sizes		
			$\bar{x}$ (no. ranges)	$\bar{x}$ (no. ranges)	$\bar{x}$ (no. ranges)
	CBSA	HBSA	CBSA mi^2 / km^2	HBSA mi^2 / km^2	TOTAL mi^2 / km^2
AD M	171	58	6.0(5)/15.5(5)	13.2(1)/34.1(1)	7.2(6)/18.6(6)
JUV M	11	32	5.0(1)/12.9(1)	7.4(2)/19.1(2)	6.6(3)/17.1(3)
AD F	25	36	2.0(2)/ 5.2(2)	2.5(2)/ 6.5(2)	2.2(4)/ 5.8(4)
JUV F	23	--	5.3(1)/13.7(1)	-- --	5.3(1)/13.7(1)
All M's	182	90	5.8(6)/15.0(6)	10.3(3)/26.7(3)	7.3(9)/18.9(9)
All F's	48	36	3.1(3)/ 8.0(3)	2.5(2)/ 6.5(2)	2.9(5)/ 7.5(5)
All AD's	196	94	4.8(7)/12.4(7)	7.8(3)/20.3(3)	5.7(10)/14.8(10)
All JUV's	34	32	5.2(2)/13.4(2)	7.4(2)/19.1(2)	6.3(4)/16.3(4)
TOTAL	230	126	4.4(9)/11.5(9)	6.4(5)/16.6(5)	5.1(14)/13.2(14)

1/ Individual ranges were determined by four or more locations. Only those ranges which had sufficient locations for an accurate estimation of individual range are included.

2/ $\bar{x}$ is the mean.

one juvenile female in the HBSA, therefore, an accurate estimation of ranges for juvenile females in the HBSA was not possible. Average individual range for the entire study was 5.1 mi^2 (13.2 km^2).

A summary of range overlaps is presented in Table 11. For the entire study 15 range overlaps occurred, of which 8 (53%) involved adults only.

Sixteen fishers each having more than four locations (Tables 8 and 9) showed no close relationship between individual range boundaries and gross topographical features. Fishers in both subareas do not seem to confine their ranges to one ridge or drainage system. Instead, most ranges encompassed at least one major ridge as well as major and minor drainages. This pattern is especially noticeable for fishers where numerous locations were recorded. Creeks and/or ridgetops occurred along portions of the range boundaries of several fishers in both subareas, but never formed a complete boundary.

Two adult males from the CBSA and one adult male from the HBSA showed movement outside their normal individual ranges during the breeding season. All three were captured more than 4.5 mi (7.2 km) from the areas that were subsequently established as their individual ranges. All three showed no indication of leaving their ranges during the non-breeding period.

One fisher in the CBSA (No. 27) showed a circuital movement pattern. Approximately 70% of all locations (59 of 84) for this animal were from regularly used drainages and ridges along a circuit of approximately 6.25 mi (10.1 km). This fisher was radio-tracked on several occasions as he moved over part of the circuit and he traveled in both clockwise and counter-clockwise directions.

TABLE 11

Summary of Individual Range Overlaps

	Fisher No.	Age-Sex	Size of Overlap	
			Acres	HA
CBSA	05,27	AD M/AD M	624	253
	10,24	AD M/AD F	635	257
	24,20	AD F/JUV F	20	8
HBSA	08,09	AD F/AD M	554	224
	09,21	AD M/AD M	747	302
	09,13	AD M/JUV M	590	239
	11,15	JUV M/JUV F	87	34
	17,19	JUV M/AD F	593	240
	17,09	JUV M/AD M	253	102
	19,09	AD F/AD M	497	201
	13,19,09	JUV M/AD F/AD M	87	34
	17,19,09	JUV M/AD F/AD M	234	95
BOTH SUB-AREAS	10,09	AD M/AD M	67	27
	10,19	AD M/AD F	34	14
	10,19,09	AD M/AD F/AD M	12	5

Habitat Selection

The selection of timber type groups by fishers for each subarea and for both subareas combined are presented in Tables 12, 13, and 14. Only those fisher habitat selection relationships which had significant chi-square values or those that we feel are biologically significant are presented. Although we use the words selection, preference, and avoidance to describe the relative presence or absence of fisher, we do not imply that fishers actually select, prefer, or avoid those habitats. For example, some apparent avoidance may occur because certain sex or age classes of fishers may physically repel others, or those others may avoid the potential repellers rather than risk entering habitat that they actually would prefer.

Vegetation and Elevation

Corral Bottom Subarea. In general, fishers of the CBSA avoided timber type groups that included hardwoods and preferred mature closed conifer forest, especially those timber types that were multiple species stands (Table 12). Females were an exception, showing no preference for mature closed conifer forest.

On a statistical basis, fishers in the CBSA neither selected nor avoided open areas. However, only four locations rather than the expected 7.05 occurred in open areas. On the basis of our field experience, they tended to avoid open areas and we suspect that a greater number of radio locations would have shown this avoidance to be statistically significant.

TABLE 12

Chi-Square and Probability Values for Fisher Locations Within Timber Type Groups in the Corral Bottom Subarea.[1,2]

Timber Type Groups	All Fishers (n=9)	Males (n=6)	Females (n=3)	Adults (n=7)	Juveniles (n=2)
Open Areas Vs. All Others	NS[4]	NS	---	NS	---
Small Conifer/ Conifer Non-Comm.Vs. All Others	---	---	---	---	---
Hardwood Vs. All Others	8.69 p<0.005 Avoid	7.17 p<0.01 Avoid	---	5.54 p<0.025 Avoid	---
Mixed Conifer/ Hardwood Vs. All Others	NS (3.79)[5] Avoid	5.11 p<0.025 Avoid	---	NS	NS
All Groups with Hardwoods[6] Vs. All Others	15.38 p<0.001 Avoid	15.90 p<0.001 Avoid	NS	9.46 p<0.005 Avoid	4.20 p<0.05 Avoid
Mature Closed Conifer Forest Vs. All Others	4.17 p<0.05 Prefer	6.51 p<0.025 Prefer	NS	NS	NS
Mature Closed Conifer Forest, Single Species Vs. Multiple Species Stands[7]	9.36 p<0.005 Prefer Multiple Species Stands	22.67 p<0.001 Prefer Multiple Species Stands	NS	9.48 p<0.005 Prefer Multiple Species Stands	NS

1/ df = 1, Chi-Square = 3.841 when $p \leq 0.05$
2/ --- = Expected Frequency <5.0
3/ The number of fishers
4/ NS = Not significant
5/ Chi-Square value
6/ Includes hardwood, mixed conifer/hardwood and small conifer/hardwood timber type groups
7/ Subset within Mature Closed Conifer Forest

TABLE 13

Chi-Square and Probability Values for Fisher Locations Within Timber Type Groups in the Hayfork Bally Subarea.[1,2]

Timber Type Groups	All Fishers (n=8)[3]	Males (n=5)	Females (n=5)	Adults (n=3)	Juveniles (n=4)
Open Areas Vs. All Others	5.40 p<0.025 Avoid	---	---	5.85 p<0.025 Avoid	---
Small Conifer/ Conifer Non-Comm.Vs. All Others	NS[4]	NS (3.56)[5] Avoid	---	5.68 p<0.025 Avoid	---
Hardwood Vs. All Others	NS	NS	---	NS	---
Mixed Conifer/ Hardwood Vs. All Others	NS (3.75) Prefer	6.04 p<0.025 Prefer	NS	5.37 p<0.025 Prefer	---
All Groups with Hardwoods[6] Vs. All Others	NS	3.91 p<0.025 Prefer	NS	NS	NS
Mature Closed Conifer Forest Vs. All Others	NS	NS	NS	6.44 p<0.025 Prefer	NS
Mature Closed Conifer Forest, Single Species Vs. Multiple Species Stands[7]	NS	NS	NS	NS	NS

1/ df = 1, Chi-Square = 3.841 when $p \leq 0.05$
2/ --- = Expected Frequency < 5.0
3/ The number of fishers
4/ NS = Not significant
5/ Chi-Square value
6/ Includes hardwood, mixed conifer/hardwood and small conifer/hardwood timber type groups
7/ Subset within Mature Closed Conifer Forest

TABLE 14

Chi-Square and Probability Values for Fisher Locations Within Timber Type Groups in the Entire Study Subarea.[1,2]

Timber Type Groups	All Fishers (n=17)[3]	Males (n=11)	Females (n=6)	Adults (n=11)	Juveniles (n=6)
Open Areas Vs. All Others	6.11 p<0.025 Avoid	6.77 p<0.01 Avoid	---	6.25 p<0.025 Avoid	---
Small Conifer/ Conifer Non-Comm.Vs. All Others	NS[4]	NS	---	6.56 p<0.05 Avoid	---
Hardwood Vs. All Others	9.37 p<0.005 Avoid	4.23 p<0.05 Avoid	NS	7.80 p<0.01 Avoid	NS
Mixed Conifer/ Hardwood Vs. All Others	NS	NS	NS	NS	NS
All Groups with Hardwoods[5] Vs. All Others	6.65 p<0.005 Avoid	NS	NS	NS	NS
Mature Closed Conifer Forest Vs. All Others	5.57 p<0.01 Prefer	4.22 p<0.05 Prefer	NS	7.79 p<0.01 Prefer	NS
Mature Closed Conifer Forest, Single Species Vs. Multiple Species Stands[6]	10.35 p<0.005 Prefer Multiple Species Stands	14.25 p<0.001 Prefer Multiple Species Stands	NS	NS	NS

1/ df = 1, Chi-Square = 3.841 when $p \leq 0.05$
2/ --- = Expected Frequency <5.0
3/ The number of fishers
4/ NS = Not significant
5/ Includes hardwood, mixed conifer/hardwood and small conifer/hardwood timber type groups
6/ Subset within Mature Closed Conifer Forest

All fishers considered together and males, showed significant or nearly significant avoidance of pure hardwoods, mixed conifer/hardwoods and all timber type groups that contained hardwoods. Adult fishers showed a significant avoidance of pure hardwoods and all timber type groups that contained hardwoods but no significant difference was found in adult use of the mixed conifer/hardwoods timber type group. Female fishers did not appear to avoid hardwoods. Thus it appears to be mostly the avoidance of hardwoods by male fishers that accounts for these results.

Juvenile fishers showed a statistically significant avoidance of timber type groups that contained hardwoods, but did not show this for stands of mixed conifer/hardwoods (Table 12). However, the chi-square value for juvenile use in mixed conifer/hardwoods is 3.49 based on an observed of 2 and an expected of 6.21. We suspect that a greater number of locations would show that juveniles also avoid stands of mixed conifer/hardwoods. The low expected value for juvenile occurrence in pure hardwood stands prevented a test of their use of this timber type group.

All fishers considered together and male fishers in the CBSA selected for the mature closed conifer timber type group (Table 12). However, of the other fisher groupings, both the adults and the juveniles also showed a greater number of observed than expected locations within mature closed conifers. The females, on the contrary, showed fewer locations than expected (32 vs. 34.88) in the mature closed conifer timber type group.

Within the mature closed conifer timber type group, we looked at single species versus multiple species stands. All fishers, male fishers and adult fishers showed a selection for multiple species stands

of Douglas-fir/white fir, Douglas-fir/ponderosa pine, white fir/Douglas-fir or mixed conifers over single species stands of Douglas-fir (Table 12). Females and juveniles did not show a statistically significant preference for multi-species stands of mature closed conifers.

Fishers in the CBSA strongly selected for riparian forests. The small percentage of mapped riparian forest habitat (0.42%) and the relatively large percentage of locations that occurred there (6.02%) indicate that riparian forest areas are very important to fishers. We were unable to test fisher use in riparian forest habitat because the expected values were less than 5.0. However, our field experience and that of other investigators abundantly confirms that riparian areas are heavily used by fishers (deVos 1951, 1952; Kelly 1977).

The area of timber types classified as riparian forest, i.e. those timber types with an SR modifier in the timber type classification (Appendix D), is underestimated. This is because the timber type maps are based on aerial photographs. Identification of the understory component that typifies a riparian area can be determined accurately only in stands with an open overstory. Heavy crown cover, particularly in drainages with steep topography where overstory trees are closely spaced, prevents identification of riparian areas.

All major and most minor drainages in the study area have riparian vegetation. However, the width of these areas is variable and the total area covered is small in proportion to other vegetative types. Very narrow or small timber types such as these, even if identifiable, were not mapped. Consequently, several areas that certainly are important

fisher habitat do not appear on the maps. Fisher locations were recorded from several of these areas but were assigned to the mapped timber type.

Therefore, both the amount of riparian forest habitat and its use by fishers is underestimated. Nevertheless, fishers appeared to spend a disproportionate amount of time in these areas, which appear to be important in both subareas for travel and escape.

Further support for heavy use of riparian areas can be seen in fisher movement patterns. On several occasions, when we followed fishers with telemetry equipment, the fishers moved through dense vegetation along stream courses. Where extensive movement data over long periods of time were obtained, as for Fisher No. 27, a distinct pattern of travel along drainages appeared.

As mentioned earlier, we obtained SPSS chi-square analyses (intensive data base) of plant communities (Parker 1978) at selected fisher locations. When individual plant communities were tested, male fishers showed a significant preference for the mixed conifer-fir plant community ($X^2 = 4.28$, $p<0.05$). There were more female (n=8) than male (n=4) locations in the mixed conifer-pine plant community indicating a nonsignificant female preference for this community type ($X^2 = 2.54$, $p < 0.05$). Adult and juvenile fishers showed no preference for any individual plant community.

Analysis of elevational data showed no statistical difference between males and females. However, an adult-juvenile comparison showed an altitude preference difference that was significant at the $p<0.003$ level. Juveniles preferred elevations between 4,000' (1,219 m) and 5,000' (1,324 m) while adults preferred lower elevations.

Hayfork Bally Subarea. Fishers in the HBSA showed somewhat different responses to the vegetation present than did fishers in the CBSA. A trend toward avoidance of open areas was shown by all classes of fishers and in the case of all fishers together and adults, this avoidance was statistically significant (Table 13). The adult fishers also showed a strong avoidance of the small conifer/conifer non-commercial timber types (Table 13). In the case of the other fisher groupings, the results were not statistically significant although nearly so for males.

When fisher use of hardwoods was compared with their use of all other timber type groups, no significant chi-squares were obtained (Table 13). There was, however, a statistically weak avoidance of hardwood stands by all fishers considered together, by males, and by adult fishers.

All fishers considered together showed nearly significant selection for the mixed conifer/hardwood timber type group (Table 13). Female fishers showed no selection for or against this timber type group. Male and adult fishers selected for use of this timber type group. The adult significance is almost entirely due to the influence of the adult males. Males were also the only fisher grouping that showed a significant preference for all timber type groups with hardwoods when compared to all other timber type groups. Adult fishers strongly selected for the mature closed conifer timber type group, but all other fisher groupings did not.

When all plant communities (Parker 1978) (intensive data base) were compared with fisher age, we found a significance value of $p<0.0003$. Within these communities adult fishers selected for Douglas-fir-pine-

madrone, Douglas-fir-live oak-chinquapin, and mixed conifer-fir plant communities. Juvenile fisher locations were spread out among all but the Jeffery pine plant community.

Adult fishers preferred the elevational range of 1,500' - 4,000' (457 - 1219 m) and juveniles preferred the 3,000' - 6,000' (914 - 1829 m) range ($p=0.0000$).

Both Subareas Combined. The selection of timber type groups by fisher for both subareas is presented in Table 14. We want to caution against use of these data to summarize fisher habitat needs for the entire study area. Such use will negate the insight that has been obtained by comparing the two differently managed subareas. For example, in the CBSA fishers tended to avoid the mixed conifer/hardwood timber type group, while fishers in the HBSA preferred it. When results from the two subareas are combined (Table 14) this difference is obscured.

When the data of both subareas are combined one point is clarified. The combined data more clearly show fisher avoidance of open areas than is shown by the data of either subarea alone.

When the relative use of plant communities (Parker 1978) (intensive data base) by males and females was compared, we found a significance value of $p<0.0276$. Within these plant communities ($n=11$), male fishers preferred the Douglas-fir-pine-madrone and mixed conifer-fir plant communities and females preferred the Douglas-fir-live oak-chinquapin plant community.

When relative use of plant communities by adult and juvenile fishers was compared, we found a significance value of $p<0.0087$. Within these plant communities ($n=11$), adult fishers preferred the Douglas-fir-

live oak-chinquapin plant community and juveniles preferred the mixed conifer-pine plant community. Ninety-two % (78 of 85) of the adult locations occurred in the Douglas-fir-pine-madrone, Douglas-fir-live oak-chinquapin, mixed conifer-fir and mixed conifer-pine plant communities. The remaining 8% (7 of 85) of the locations were distributed among three other plant communities. Sixty-seven % (26 of 39) of the juvenile locations were in the four above mentioned plant communities and the remaining 33% (12 of 39) locations were distributed among six other plant communities.

Table 15 presents some data to facilitate comparison of the two subareas. For most of the comparisons, sample size was not large enough to allow for a chi-square test. However, we feel these data point to biologically significant trends in habitat use differences between the two subareas.

Male fishers in both the CBSA and the HBSA occur more frequently in the more closed mixed conifer-fir stands than in the rather open mixed conifer-pine communities (Table 15). Males in the HBSA occurred more frequently in habitat types having greater than 70% overhead canopy closure than in 40-70% canopy closure, while males in the CBSA occurred most often in areas having 40-70% canopy closure. This occurrence of CBSA males in areas having a more open canopy may be the result of the greater percentage of selectively cut areas in the CBSA (Table 1). Female fishers in the CBSA were found more commonly in the rather open mixed conifer-pine plant community and in habitat types having 40-70% canopy closure. In contrast, female fishers in the HBSA occurred more often in the denser mixed conifer-fir plant community and in areas with greater than 70% canopy closure.

TABLE 15

Relative Fisher Use of Two Plant Communities and Two Degrees of Canopy Closure in the Corral Bottom and Hayfork Bally Subareas

Habitat	Male		Female		Adult		Juvenile	
	CBSA	HBSA	CBSA	HBSA	CBSA	HBSA	CBSA	HBSA
Plant Community								
Mixed Conifer-Fir	23.1[1] (6/26)[2]	26.5 (13/49)	4.2 (1/24)	12.0 (3/25)	19.4 (7/36)	16.3 (8/49)	---	32.0 (8/25)
Mixed Conifer-Pine	3.8 (1/26)	6.1 (3/49)	20.8 (5/24)	4.0 (1/25)	11.1 (4/36)	2.0 (1/49)	14.3 (2/14)	12.0 (3/25)
Canopy Closure								
Large Tree Stage 40-70% Canopy Closure	42.3 (11/26)	30.6 (15/49)	62.5 (15/24)	32.0 (8/25)	50.0 (18/36)	34.7 (17/49)	57.1 (8/14)	24.0 (6/25)
Greater Than 70% Canopy Closure	19.2 (5/26)	40.8 (20/49)	25.0 (6/24)	40.0 (10/25)	19.4 (7/36)	42.9 (21/49)	28.6 (4/14)	36.0 (9/25)

1. Percentage occurrence in habitat
2. (6/26) means that 6 of the 26 telemetry locations for male fisher that were studied intensively on the ground occurred in the mixed conifer-fir plant community.

Adult fishers in both subareas were located more often in the mixed conifer-fir plant community than in the mixed conifer-pine community (Table 15). Adults in the CBSA were found more often in the 40-70% canopy closure habitat types while adults in the HBSA were found more often in habitat types with a canopy closure of greater than 70%. Of these two plant communities, juvenile fishers in the CBSA were found only in the more open, mixed conifer-pine community and occurred more often in habitat types having between 40-70% overhead canopy closure than in those with greater than 70% closure. Juvenile fishers in the HBSA were found most often in the rather dense, mixed conifer-fir community and in habitat types with greater than 70% canopy closure.

Elevation was the only physical environmental parameter to which fishers showed any statistically significant response and it was similar in the two subareas. Adult fisher preferred elevational ranges of about 1,500' - 4,500' (457 - 1,372 m) and juveniles 2,500' - 6,000' (762 - 1,829 m) ($p=0.000$). Fisher in both subareas have shown no obvious seasonal shift in elevation. Elevations at fisher locations ranged from 1,550' (474 m) to 4900' (1,494 m) in the CBSA and 1,475' (450 m) to 5,950' (1,814 m) in the HBSA.

Den/Rest Sites

There were no striking differences in the type of den/rest sites selected by fishers in the two subareas.

Nine times in the CBSA (Table 16) and 8 times in the HBSA (Table 17) fishers were located in dens or resting sites. One maternal den, located 3 mi (4.8 km) to the south of the HBSA is included.

TABLE 16

Characteristics of Den/Rest Sites for the Corral Bottom Subarea

Fisher No.	Sex	Age	Observation Date	Type Of Site[1]	Live/ Dead	DBH In./Cm	Harvest Type	Timber Type	Distance To 1° Road M	Location of Fisher/ Collar at Time of Discovery
14	M	AD	12 Jan 78	Yarded Log Pile	N/A	N/A	Clearcut Powerline Corridor	SM	0-50	In Center of Pile
01	M	JUV	16 Feb 79	DF-Snag	Dead	56/142	Unharvested	DF3G	101-150	Unknown
20	F	JUV	23 Feb 79	DF-Snag	Dead	41/104	Select Cut	DF3G	101-150	Unknown
20	F	JUV	24 Feb 79	LO	Live	54/137	Select Cut	DFPP3N	Greater Than 300	In Hollow Trunk
20	F	JUV	25 Feb 79	Mature DF	Live	45/114	Unharvested	DF3G	Greater Than 300	On Lateral Branch Approx. 30' Above Ground
20	F	JUV	1 Mar 79	Mature DF	Live	67/170	Unharvested	DF3G	Greater Than 300	On Lateral Branch Greater Than 100' Above Ground
10	M	AD	17 Apr 79	Mature DF	Partly Dead	32/81	Unharvested	DF3G	Greater Than 300	Unknown
10	M	AD	26 Apr 79	Mature DF	Partly Dead	56/142	Select Cut	DF3G	51-100	Unknown
24	F	AD	18 Apr 79	Mature SP	Partly Dead	57/145	Unharvested	DF4N	101-150	Unknown

[1]DF=Douglas-Fir, LO=Live Oak, SP=Sugar Pine

TABLE 17

Characteristics of Den/Rest Sites for the Hayfork Bally Subarea

Fisher No.	Sex	Age	Observation Date	Type Of Site[1]	Live/ Dead	DBH In./Cm	Harvest Type	Timber Type	Distance To 1° Road M	Location of Fisher/ Collar at Time of Discovery
08	F	AD	12 Jul 78	Underground Hole	N/A	N/A	Select	DF3G	Greater Than 300	In Hole at Base of Fir Snag
09	M	AD	8 Oct 78	Downed Fir Log	Dead	44/112	Select	DFPP3G	101-150	Cavity in Root
09	M	AD	27 Apr 79	Mature DF	Live	45/114	Unharvested	DF4G	Greater Than 300	In Branches
11	M	JUV	16 Dec 78	Mature DF	Live	30/76	Select	DFSP/NH	Greater Than 300	In Branches
13	M	JUV	29 Nov 78	Slash Pile	Dead	>64/>163	Select	DFPP3N	Greater Than 300	Under Huge log
17	M	JUV	11 Mar 79	Mature DF	Live	>64/>163	Unharvested	DFWF3N	200-250	In Branches
19	F	AD	15 Aug 79	LO	Live	22/56	Unharvested	DFWF3P/NH	Greater Than 300	In Cavity
21	M	AD	30 Jun 79	Medium DF	Live	20/51	Unharvested	DF3G	Greater Than 300	In Branches
---	F	AD	4 May 79	Pine Snag	Dead	35/89	Unharvested	N/A	Greater Than 300	Maternal Den--Two Kits in Hole

[1] DF=Douglas-Fir, LO=Live Oak

Corral Bottom Subarea. Eight of the den/rest sites in this subarea occurred in trees and the ninth was within a pile of yarded logs. The yarded logs were located in a powerline right-of-way within 50' (15.2 m) of an infrequently used forest road that was impassable by two-wheel-drive vehicles when the fisher was located. The pile measured approximately 75' x 25' x 5' (22.9 x 7.6 x 1.5 m), and was weathered and unburned. There was no overstory within 75' (22.9 m) of the pile but there were a few widely spaced ponderosa pines and incense cedars approximately 30' (9.1 m) in height. Immediately surrounding the pile were grasses and a few large shrubs. A dense stand of old growth Douglas-fir bordered the area on two sides approximately 75' (22.9 m) from the pile. The adult male fisher was located in the approximate center of the pile. The large size of the logs prevented determination of its exact location.

The remaining eight sites were all within the Douglas-fir-live oak-chinquapin plant community (Parker 1978). Each of the den/rest trees was more than 50' (15.2 m) in height and had a large DBH [$\bar{x}$= 51.3" (130 cm) range = 32"-67" (81 - 170 cm)]. In four cases the den/rest tree was the largest and tallest tree in the immediate vicinity. None of the trees showed outward evidence of disease; one snag had a single conk.

All den/rest trees occurred more than 100 m from the nearest clearcut, more than 60 m from the nearest road and were within the mature closed conifer timber type group. Five sites were in unharvested areas and three occurred in selectively cut areas where less than 20% of the overhead canopy had been removed.

The fisher that was located inside the live oak was less than 15' (4.6 m) from an opening at the base of the tree. Poor lighting

prevented our determining its exact location in the fire-hollowed cavity. In the other trees the specific part that the fisher was using could not be determined, although it was within the uppermost one-third of the total height. The density of branches and surrounding topography often prevented a clear view of the crown. Two trees had small cavities leading into the heartwood and several had spaces between the bark and the trunk that were large enough to conceal a fisher. Both snags had broken tops which may have led into larger cavities below. In two cases we observed fishers peering at us from large lateral branches. We were unable to tell whether the fishers were using the branches as resting areas or if this behavior was a reaction to our presence below.

Hayfork Bally Subarea. Of the eight den/rest sites, five occurred in trees, one was underground, one was in a cavity in a downed log and one was under a slash pile. The maternal den was in a standing pine snag. Height of the trees varied from 25' to 134' (7.6 - 40.8 m) and DBH varied from 19" to over 64" (48 - 163 + cm). Five sites were in the Douglas-fir-live oak-chinquapin plant community, one in the Douglas-fir-live oak-madrone, two in the mixed conifer-fir and one in the white fir-madrone plant communities (Parker 1978).

One site was within 50 m of a clearcut but the remainder were more than 250 m from the nearest clearcut. All den/rest sites were greater than 100 m from the nearest road and seven were more than 300 m. Seven sites were in the mature closed conifer timber type group and two were in the mixed conifer-hardwood group. Eight sites were in unharvested areas and one was in a select cut.

Fisher No. 08, an adult female, slipped off her radio collar sometime between 27 June and 12 July 1978. The collar was recovered

from an underground hole at the base of a conifer stump in the Big Bar Creek drainage. The collar (not the transmitter package), upon recovery, had several small punctures in it. These holes might have been made by young fishers, because at the time of her capture, we thought she might be pregnant. The underground den hole was located at the base of a 14' (4.6 m) decayed conifer stump. The hole was about 14" (36 cm) wide, approximately 39" (1 m) deep and about 20" (51 cm) from floor to ceiling. The soil was loose, rocky and light brown in color. Some woody debris and moss was in the hole, but it did not appear to be nest material.

Fisher No. 09, an adult male, was found inside a downed decaying Douglas-fir log at 1415 hours on 6 August 1978 in the Big Bar Creek drainage. The entrance to the den was through a hollow, rotted root on the north side of the log. The tunnel went over the heartwood of the bole to a chamber in a root on the south side of the log. The tunnel passed just under the intact bark. The chamber measured 39" (1 m) long, 8" (20 cm) wide and 12-14" (30-35 cm) high. The floor consisted of woody debris and spiny chinquapin (Castanopsis) fruit hulls. Much downed woody material was present around the den.

Fisher No. 09 was also treed in a Douglas-fir at 1200 hours on 17 August 1979, in Sailor Bar Creek. We were pursuing the animal and forced him up the tree. We were not able to determine his exact location in the tree.

Fisher No. 13, a juvenile male, was located at 1545 hours on 29 November 1978 under a huge, 50" (127 cm) downed Douglas-fir log on the ridge separating Price and Big Bar Creeks. Many smaller logs and bark lay criss-crossed around the log. It was raining and snowing at the time of discovery but it was dry under the log.

Fisher No. 11, a juvenile male, was treed in a large Douglas-fir at 1400 hours on 16 December 1978 in Packers Creek on the eastern end of the HBSA. He sat on limbs 60' (18.3 m) from the ground and approximately 1' (30 cm) out from the trunk of the tree while watching us intently and continuously as we observed him. The fisher left the tree within 15 minutes of our departure.

Fisher No. 19, an adult female, was treed in a live oak at 1300 hours on 15 August 1979 in Price Creek. She was in a cylindrical cavity which ran along the bole. The cavity was open at the top and bottom.

Fisher No. 21, an adult male, was treed in a Douglas-fir in the Big Creek drainage on 30 June 1979. He was located near the middle of the tree in a witches' broom.

On 29 April 1979 timber fallers, working about 3 miles (4.8 km) S-SE of Hayfork Bally on the east slope of Thompson Peak, felled a pine snag (probably Pinus ponderosa). The upper half of the nearly limbless snag crumbled when it hit the ground. At about the 35' (10.6 m) mark from the base of the 45' (13.7 m) snag lay two fishers less than one week old. Their eyes had not yet opened. The female kit was killed in the fall but the male survived and was turned over to the California Department of Fish and Game.

On 4 May 1979 this maternal den was inspected. Although this den site was to the south of the study area, we feel this type of information is well worth including in this report. One probable fisher scat containing berries, which was not present on 29 April was collected near the snag on 4 May. The den was on a 26° slope with an aspect of 135° (SE). Soil was loose gray/brown slate derived soil. An old bee honeycomb in the base of the snag was exposed when the snag was felled.

The lower half of the snag was solid, the upper half rotten. Several large, short limbs were present at the top of the snag. No cavity of any kind was discernable after the snag hit the ground. DBH class was 29-43" (74-109 cm). No timber type was available for this location.

Food - Habitat Relations

Dead wood material may be important to fishers as den, rest or escape sites and as habitat for prey species such as small mammals. However, our data are inconclusive on these points.

Grenfell and Fasenfest (1979) found false truffles (Rhizopogon spp.) in 4 of 8 fisher stomachs from Trinity County. Two stomachs held Peromyscus spp. and one held Reithrodontomys megalotus. Whether or not fishers fed directly on these fungi or acquired them indirectly from their prey was not determined. Ingestion of false truffles by fishers, even secondarily, is of great interest. These fungi may require passage through animals for germination and are apparently essential for tree regeneration and growth in areas similar to our study area (Fogel and Trappe 1978, Bergstrom 1979). With the now recognized silvicultural importance of the hypogeous fungi-mammal-tree growth interelationship and the possible participation of fishers in this beneficial relationship we believe that future research may show the fisher to be an integral part of the successional pattern of its forest habitat.

Much information about fisher predation on porcupines has been reported in the literature. In only one instance did we find evidence of a fisher-porcupine interaction on our study: one quill was found exiting from the foreleg of an adult male fisher in the HBSA. Snow tracks of porcupines were not observed in either subarea and we saw

only two porcupines in the study area during the entire investigation. Therefore, we do not feel we have enough evidence to say anything about fisher-porcupine relationships in our study except the speculate that the near absence of porcupines may possible be the result of fisher predation.

Population Characteristics

Density Estimation

Mean individual range for nine fishers with at least four locations in the CBSA was 4.4 mi^2 (11.5 km^2) and for five fishers in the HBSA it was 6.4 mi^2 (16.6 km^2). Mean individual range for the 14 fishers in the entire study was 5.1 mi^2 (13.2 km^2) (Table 10). Assuming the study area did not contain large areas that were poor fisher habitat, fishers were evenly distributed and all resident fishers were captured, the mean number of fishers per square mile of fisher habitat was 0.17 (0.44 per km^2). We calculated this mean based on our data on 10 fishers alive at the same time.

Sex and Age Ratios

Sex ratio for the entire study was 66:34, male to female, based on 21 fishers captured. With the exception of a 50:50 sex ratio in the HBSA for the 1977-78 trapping period, more males than females were trapped during each trapping period and for both trapping periods combined (1977-78 and 1978-79) (Table 7). However, the difference from a 50:50 sex ratio was not significant ($p>0.05$).

The age ratio for the entire study was 56:44, adult to juvenile, based on 21 fishers captured. This is not significantly different from a 50:50 ratio ($p>0.05$).

Mortality

Seven radio-collared fishers died during the study (Table 18). Four of these fishers were killed and three died of unknown causes (see Individual Fisher Accounts, Appendix E).

TABLE 18

Fisher Mortalities

	Fisher No.	Sex	Age	Length of Time Collared [1]	Timber Type At Recovery Loc.	Suspected Cause Of Death [2]
CBSA	04	F	AD	19 Nov 77 - 8 Feb 78	DFPP3P/NG	Unknown
	05	M	AD	19 Nov 77 - 15 Sep 79	DFWF3PNH	Unknown
	06	F	JUV	20 Nov 77 - 4 Dec 77	Unavailable	Unknown Predator Suspected Fisher
	27	M	AD	11 Feb 78 - 10 Feb 79	DF3S/NH	Unknown
HBSA	13	M	JUV	23 Nov 78 - 22 Jan 79	PP1N/P	Predation-Large Canid
	15	F	JUV	18 Feb 79 - 31 Mar 79	DF3G	Unknown Predator Suspected Raptor
	17	M	JUV	10 Mar 79 - 11 May 79	PP2S/SM [3]	Unknown Predator

[1] Release Date - first location at recovery site
[2] See Appendix E for specific details
[3] As given on Timber Type Map, actual--DF3G

DISCUSSION

Density Estimation

Our best data of fisher numbers are those derived from home range sizes; these yielded a density of 0.20 fishers per mi^2 (0.08 per km^2). This equals one fisher per 5.1 mi^2 (3.2 per km^2). We consider this to be a conservative estimate of fisher numbers in the study area as we do not believe that we captured every fisher, and because trapping was not uniform throughout the study. Furthermore, we recorded fisher tracks outside of known fisher ranges and within known fisher ranges we found tracks which we knew were not made by the resident fisher. There were areas of up to 5.0 mi^2 (12.9 km^2) between known fisher ranges where we did not record locations other than tracks. Habitat in these areas was similar to that of known fisher habitat. We do not have sufficient data, especially mortality data, to determine if the fisher population was increasing, decreasing or was static. Kelly (1977) calculated an average density of one fisher/9.05 km^2 and an ecological density of one fisher/5.7 km^2 from ten radio collared fishers in New Hampshire. Our fisher population was therefore about twice as dense as Kelly's.

Habitat Analysis

Snow tracking and radio telemetry data yielded different estimates of habitat use. The differences in apparent habitat selection between the tracking and telemetry data can be explained by the bias that resulted from both the nature of the tracking substrates and the locations of roads within the study area.

In the study area, most snow falls at night. Daytime temperatures usually rise above freezing and snow caught in the overhead canopy melts and falls to the ground, frequently obliterating tracks. The result is a pockmarked snow surface that often makes tracking impossible. Consequently, the best tracking conditions tend to be in areas that lack appreciable high overhead canopy; and these are the open areas and plantations. In several cases, a track that crossed a plantation was lost when it entered an area of high overhead canopy. If positive location of the track under the canopy was impossible, the location was not recorded.

A second chance for bias in the same direction involved our use of forest roads as tracking transects. Roads within the study area connect areas that have been logged. The chances of crossing or traveling along the edge of a plantation were greater on roads than if random tracking transects had been used. For these reasons, we consider the relative use of habitat displayed by our tracking data to be strongly biased, but because of other uncertainties, we cannot give a confident measure of the magnitude of this bias. Therefore, it was necessary to separate tracking locations from telemetry locations for the analyses of the relative use of habitat types by fishers.

Although the tracks showed that fishers enter open areas, and especially dense brush fields of whitethorn weighted down by snow, the telemetry data show that in general fishers avoid open areas and even tend to avoid the more open timber type groups. Most tracks found in the whitethorn brush fields were those of hunting fishers that on occasion traveled much more directly through other areas. It is possible that where such whitethorn patches occur, they may sometimes be important hunting areas for fishers.

Our radio telemetry triangulations were mostly obtained by one person traveling alone. If a radio collared fisher was traveling rapidly cross country and even if it was intensively hunting through an area, we were unlikely to obtain for it an acceptable set of radio bearings. Therefore it is probable that our radio telemetry data fail to show adequately the areas through which fishers travel and hunt. None the less, our tracking data are surely biased, so the only possible conclusion is that other data will be needed before the traveling and hunting habitats for fisher in this area can be adequately characterized. Likewise, if a radio-collared fisher can satisfy some essential need quickly, e.g. drinking, this essential need and its location are very unlikely to be detected through telemetry. We obtained most of our information through telemetry so we also have relatively little information about fisher needs that are satisfied quickly.

Our results show the fisher to be an old-growth forest species in our area. Several lines of evidence support this conclusion.

Our radio telemetry data show that fishers avoided open areas, as defined in our timber type key (See Tables 12, 13, & 14). Avoidance of open areas by fishers has also been documented by Coulter (1966) and Powell (1977). Coulter stated that:

> Fishers were not found to enter any open field during more than 61 mandays of tracking.... Fishers showed a strong tendency to remain in places where there was overhead cover. This was a definitive behavior trait of the animals tracked at all of the study units.

In addition, Hash and Hornocker (1978) did not locate fishers in clearcuts and Kelly (1977) stated that although the number of open areas in his study areas was small, "fishers were never located in nonforested areas."

Considering all fishers together, in the relatively uncut HBSA, we found only one timber type group that showed statistically significant selection, and that was avoidance of the timber type group that includes open area timber types. By contrast, in the more heavily cut CBSA the fisher reaction to open timber types was not significant. There were about equal amounts of open area timber types in the CBSA and HBSA fisher ranges, however, relatively much more select cutting had occured in the CBSA. Our interpretation is that the rest of the habitats in the HBSA more nearly satisfied the fishers' requirements than did the comparable habitats in the CBSA. Thus when there is enough sufficiently dense habitat, fishers avoid open areas. This suggests the need to know more about the effects of selective cutting on fishers.

Fishers tended to avoid the small conifer/conifer non-commercial timber types which includes many stands in fairly early successional stages. These stands tend to be more xeric than the old growth stands or similar sites. No statistical test could be made for this timber type group in the CBSA because of the relatively small number of expected locations within it. However, in the HBSA, this timber type group was avoided by adults ($p<0.025$) and by males ($p<0.10$). Combining data from both areas, only the adults showed significant avoidance of this timber type group.

The hardwood timber type group is perhaps more xeric than the small conifer/conifer non commercial timber type group. In general, fishers avoided pure hardwoods as evidenced from CBSA and entire study data. The overall tendency of fishers to avoid the small conifer/conifer non commercial timber type groups was less strong than their avoidance of the hardwood timber type group. This suggests a possible avoidance of xeric conditions even where forest vegetation occurs.

Our findings on relative use of plant communities by fishers appear to contradict our results showing that some fishers may avoid timber types that contain hardwoods. This apparent contradiction is explained when plant communities are compared with timber types. Almost all plant communities in the study area contained hardwoods. These were usually a few, widely spaced, midstory trees. A small hardwood component such as this is not tall or concentrated enough to appear on the timber type maps. Thus only areas with substantial hardwood components are given a hardwood designation on the timber type maps even though most others contain some hardwoods.

CBSA fishers avoided the mixed conifer/hardwood timber type group while the HBSA fishers preferred it. A similar difference in response was displayed when the data were pooled for the three timber type groups containing hardwoods. In general, CBSA fishers strongly avoided all groups with hardwoods and HBSA males preferred them.

If we hypothesize that the best fisher habitat in the study area consists of some mixture of conifers and hardwoods, we can find an explanation for the striking differences in fisher response to timber types in the two subareas. On this basis, we would expect that fishers of the CBSA would have more hardwoods within their individual ranges

than is optimum for them, so they will be seen to avoid such timber types relative to their areas. This will be true even though they might spend relatively more time in hardwoods than do fishers whose individual ranges encompass lesser areas of hardwoods. In the HBSA, hardwoods were relatively less abundant so the opposite occurs.

Using the same hypothesis, we could predict that for the most desirable timber types, subtle differences in desirability will show most quickly in areas where there is a limited supply of those timber types. In such cases the animals must spend more time in the most desired type relative to its area. In other words, since the most desirable timber type is in short supply within the fishers' individual ranges, they will spend large amounts of time there relative to the areas covered by that timber type, i.e., they will show strong preference for the most desirable timber type.

Again, the data support this hypothesis, and especially so in the case of single species versus multiple species stands of mature closed conifer forests. In the HBSA, there was no significant selection for the multiple species stands, while in the CBSA the selection by males was very highly significant and it was highly significant in the cases of adults and of all fishers considered together.

Fishers preferred the mature closed conifer forest timber types. A fairly strong preference was shown by all fishers, males and adults, CBSA males and HBSA adults. These data again reinforce our belief that the Trinity County fishers are old growth animals.

Fishers in the CBSA strongly selected for riparian forests. The small percentage of mapped riparian forest habitat (0.42%) and the relatively large percentage of locations that occurred there (6.02%)

indicate that riparian forests are very important to fishers. We were unable to test fisher use of riparian forest habitat because the expected values were less than 5.0. However, our field experience in both subareas confirms that riparian forest areas are heavily used by fishers. Kelly (1977) reported that New Hampshire fishers selected for wetland associations in both winter and summer.

Further support for heavy use of riparian areas can be seen in fisher movement patterns. Where extensive movement data were obtained over long periods of time, as for Fisher No. 27, a distinct pattern of travel along drainages appeared. In both the CBSA and the HBSA 50 percent of total fisher captures were in riparian areas. In the HBSA, on three of seven occasions when we followed fishers, they traveled along riparian areas. These areas comprise considerably less than three-sevenths of known fisher range within the HBSA.

Effect of Logging on Fisher Density and Distribution

The fisher is a mature forest species as shown by our data and by others (de Vos 1952, 1957; Schempf and White 1977; Kelly 1977). An adequate proportion of mature timber needs to be present through time in order for an area to maintain a population of fishers. As mature timber habitat is removed or modified we may expect the number of fishers to decrease. Those found in the remnant mature forest after such human activities would probably be the resident animals with well established individual ranges and the very strong individuals from the newly logged areas that succeed in displacing residents. Adult male fishers seem the most likely to remain or to gain new individual ranges because they are

clearly the largest and strongest animals. Female fishers would be susceptible to intrapsecific crowding pressure because of their substantially smaller size. Even in the best habitats, juveniles may suffer greater mortality than adults due to their inexperience, their smaller size, and to the increased chance of interspecific and intraspecific encounters during dispersal. Such juvenile mortality probably increases as habitat is lost or its quality deteriorates.

Clearcut Logging and Replanting

Clearcut logging of mature timber obviously removes fisher habitat. A new clearcut is valueless to fishers. Once a dense cover of vegetation, especially whitethorn, is established, fishers use these areas for hunting; however, such early successional stages are short-lived. The long term maintenance of fisher numbers within northwestern California may be further affected by current silvicultural practices. Subsequent to cutting and loss of the insulating canopy, the site is exposed to the desicating effects of increased insolation and wind. The result is a more xeric open forest with Ponderosa pine and some fir rather than the original mesic closed forest of predominantly Douglas-fir and white fir. If this trend continues, the overall vegetative composition of the forest will be changed. The long term effects may prove deleterious for fishers, judging from our data and also from Schempf and White (1977). They found that only eight percent of 206 fisher sightings occurred in forests composed of greater than 80 percent *Pinus* species.

Select Cut Logging

In pre-salvage or selective harvesting of timber in the study area, the trees removed were primarily large commercial conifers. This caused more xeric conditions by opening up the overhead canopy. The removal of snags reduced the number of possible den/rest sites for fisher and other wildlife. During selective cutting, some hardwoods were cut, but most remained. Thus, in the extensive areas of selective cutting, the forest was opened up, the relative abundance of hardwoods was increased and potential den sites were removed. In the CBSA, the large amounts of hardwood and mixed conifer/hardwood timber types undoubtedly resulted from such logging.

The fisher population in the CBSA may be under more pressure from logging than our timber type data show. Our results were obtained with timber type maps based on aerial photographs taken in 1975. Since then considerable timber has been removed from the study area, especially the CBSA.

The past and present selective timber harvest has undoubtedly influenced the fisher population on our entire study area. Unfortunately, accurate data on the amount, dates and locations of selectively cut areas were unavailable. This information would be extremely helpful in understanding habitat modification within our study area. Additional monitoring of fisher reaction to and use of select cuts will be necessary for the understanding of fisher biology in our area.

Evidence That Adult Males Restrict Female and Juvenile Distribution

Fishers in the two subareas evidenced quantitatively different responses to the timber type groupings (Tables 12 and 13). In the CBSA, five timber type groups had sufficient data to allow testing for preference or avoidance by fishers. In all five, females showed no significant selection while the males very strongly avoided all groups that contained hardwoods when combined for testing, strongly preferred mature closed conifer forest types and very strongly favored multiple species stands within the mature closed conifer forest. In the HBSA, where a larger proportion of mature closed conifer forest occurs, this trend was not apparent, although the males selected for the mixed conifer/hardwood timber type group while females did not.

From this, we suspect that within the CBSA the larger, stronger males with well established ranges were causing the females to occupy areas of less preferred habitat. The HBSA, which has the most mature closed canopy forest habitat, ought to provide more optimum habitat for females and juveniles than does the CBSA because we have no reason to believe that given free choice, they would prefer to occupy different habitats than males choose. A less likely alternate hypothesis is that female and juvenile fishers elect to occupy different habitats than do adult males.

Further evidence to support the hypothesis that male fishers in the CBSA may be restricting the use of habitats by females and juveniles is seen in the analysis of fisher use of two plant communities and two degrees of canopy closure (Table 15). Of these two communities, the

mixed conifer-fir is denser than mixed conifer-pine. All sex and age classes in the HBSA occurred more frequently in mixed conifer-fir stands with a canopy closure >70%. In contrast, in the CBSA males and adults occurred more frequently in mixed conifer-fir stands with a canopy closure of 40-70%, while females and juveniles were found in the more open mixed conifer-pine stands having 40-70% canopy closure (See Appendix D, Timber Type Key). In the study area the mixed conifer-fir community occurred most commonly on mesic north facing slopes, while the mixed conifer-pine community occupied drier south facing slopes. Both Kelly (1977) and Hash and Hornocker (1978) have documented fisher preference for mesic habitat types.

Based on the 50:50 age ratio in the HBSA, the fisher population in the HBSA (Table 7) appears to be stable, but the 62:38 age ratio in the CBSA (Table 7) suggests that the fisher population in that subarea may not be stable and may even be declining. Coulter (1966) reported a 64:36 adult to juvenile ratio from all of Maine, but stated that "a higher proportion of juveniles was present in samples from southern Maine where fisher populations were increasing rapidly". If habitat in the CBSA is barely adequate or inadequate for the fishers present it should result in dispersal of subordinate fishers into suboptimal habitat, which may result in higher mortality.

Four radio-collared fishers in the CBSA died, all within this subarea. Three of these, two adults and a juvenile, were recovered from areas that were avoided by fishers (clearcuts, areas lacking overhead canopy). The fourth, an adult male, was recovered from an area with a high percentage of hardwoods. In addition, the collar from another

juvenile male was recovered from a brushy clearcut. Of three mortalities of fishers collared in the HBSA, two juvenile males were killed within the CBSA. One was recovered in a brushy clearcut and the other was recovered from a small open grassy area in a mixed conifer forest. The single mortality that occurred within the HBSA, a juvenile female, was found submerged in a creek within a Douglas-fir stand approximately 30 m from an open brushy clearcut. We suspect that this animal was killed by a large raptor (See Appendices F & G, Fisher No. 5).

In summary, our evidence indicates that adult male fishers are influencing female and juvenile distributions. CBSA adult males generally preferred the multiple species stands of mature closed conifer forests and avoided the hardwoods. CBSA females had no significant selection for timber type groups. In the HBSA, this trend was not apparent. CBSA adults and males were found in the more open mixed conifer-fir plant communities while females and juveniles were found in the more open mixed conifer-pine plant communities. All HBSA fishers were found in the denser mixed conifer-fir plant communities. The higher age ratio of adults to juveniles in the CBSA suggests that that population may not be stable. Higher mortality may result from dispersal of subordinate animals into suboptimal habitats. Six of seven mortalities in the entire study occurred in the CBSA, although two of these fishers were captured in the HBSA. We have no reason to believe that differential habitat selection by sex and age groups existed in our study.

If correct, the adult male exclusion of females and juveniles hypothesis has important implications for timber management. When

management objectives are to maximize fisher numbers and population stability, timber harvest of mature closed conifer forests should be minimized.

Characterization of Optimum Fisher Habitat

If we consider the HBSA, as it was during our study, to be good fisher habitat, we can attempt to roughly characterize optimum fisher habitat in our research area by looking at Table 13 to see which timber type groups are favored or avoided. We may then suggest related increases or decreases in the areas of these timber types. On this basis, the HBSA might be improved by decreases in open areas and in the small conifer/conifer-noncommerical timber types and by increases in mixed conifer/hardwoods and mature closed conifer timber types. Since most or perhaps all of these changes suggest a return to more pristine conditions in this relatively unlogged subarea, the departure from optimum fisher habitat that has occurred in the more heavily logged CBSA is emphasized.

Another way to look at the problem of defining optimum fisher habitat is to look at the relative numbers of locations within timber type groups for adult female and male fishers in the HBSA (Table 19). We will assume that they had free choice of habitat. On this basis these data suggest that near optimum habitat in our study area, given in terms of timber type groups, consists of about 5% hardwoods, 60-80% mature closed conifers, 20-30% mixed conifer/hardwoods and 2-5% small conifer/conifer-noncommercial. In addition, riparian areas are probably very important. As explained earlier, they do not appear in these timber type calculations because of the small areas they cover.

Table 19

Fisher Locations in Timber Type Groups
Within the Hayfork Bally Subarea

Timber Type Groups	Number/Percent of Total			
	Adult Male	Adult Female	Juv Male	Juv Female
1. Open Areas	---	---	---	---
2. Plantation/Brush	---	---	5/13.5	---
3. Hardwoods	3/4.7	---	3/8.1	---
4. Mature Closed/ Conifer Forest	39/61.9	28/77.7	23/62.2	3/75.0
5. Mixed Conifer Hardwood Forest	18/28.6	7/19.4	4/10.8	---
6. Open Conifer Forest with Shrub	---	---	1/2.7	---
7. Open Forest with Grass	---	---	---	---
8. Small Conifer or Conifer/NC	3/4.7	1/2.7	---	1/25.0
9. Small Conifer/ Hardwoods	---	---	---	---
10. Riparian Forests	---	---	1/2.7	---
11. Unknown/Unlabelled	---	---	---	---
	n=63	n=36	n=37	n=4

Other Activities Within the Study Area

At the levels we encountered during our study, sport hunting, off-road-vehicle use, camping, hiking and probably fur trapping did not appear to be signficantly detrimental to fishers in our study area. However, these activities can be expected to increase and should be monitored. Special attention should be given to the possible effects of trapping in areas that have been opened up by logging activities. Experience in the eastern United States has shown that trapping for fishers must be carefully monitored so as to prevent overharvesting and subsequent population declines. Although fishers are presently protected in California they are easily trapped and non-target capture of fishers by trappers are common. Trapping in areas that have undergone extensive logging and roadbuilding may further endanger fisher populations in northwestern California.

MANAGEMENT RECOMMENDATIONS

We hope that if management decisions are based on this report, those making them will move cautiously and conservatively. Radiotelemetry data, as explained earlier, yield a biased measure of the life of an animal. Consequently, our conclusions are tentative because we have almost certainly failed to detect important habitat needs of fishers. Anyone using the information in this report needs to be well avare of these probable, but unavoidable shortcomings.

Our data strongly suggest that optimum fisher habitat in the study area is old-growth mixed conifer forest with a small hardwood component in the understory. Our recommendations recognize that some of this forest will be cut and therefore are designed to minimize the impact of that cutting on fishers.

Timber harvesting should, of course, be conducted so as to minimize damage to the environment and done rapidly so as to reduce the time over which disturbance occurs. Snags and downed woody material should be left whenever possible.

Harvest of old-growth timber should be minimal. Selective cutting of old-growth stands would probably have the least impact on fishers, especially if the largest and oldest trees and those with cavities are left uncut. Since fishers tend to avoid open areas, select cutting should be done so as to maintain at least a 60% overhead canopy.

Clear cutting of old-growth stands will have the most impact on fisher populations. Multiple species stands of old-growth conifers are of especial importance to fishers and these stands should be left uncut if at all possible. Any clearcut of an original stand should be revegetated as soon as possible, in almost all cases with the same species

composition as was removed by harvesting. Because of fisher preference for multiple species stands it seems logical that in revegetation, monoculture should be avoided.

Ecotones bordering dense forest may be important to fishers for foraging and have been shown to be beneficial to other wildlife. Therefore, small or narrow and sinuous clearcuts that provide more ecotone areas than do large wide ones are to be preferred.

Certain areas are of especial importance to fishers. Conifer-riparian corridors and saddles between major drainages are much used by fishers and consequently these should not be cut.

LITERATURE CITED

Beaty, D.W. 1978. Antenna considerations for biomedical telemetry. Telonics, Mesa, AZ 17 pp.

Benson, D.A. 1959. The fisher in Nova Scotia. J. Mammal. 40(3):451.

Bergstrom, D. 1979. Small mammals traffic in truffles. Forestry Research West. US Forest Service. (1):1-31

Brander, R.B. and D.J. Books. 1973. Return of the fisher. Nat. Hist. 82(1):52-58.

Clem, M.K. 1977. Food habits, weight changes and habitat use of fisher (Martes pennanti) during winter. M.S. Thesis, Guelph Univ.

Coulter, M.W. 1966. Ecology and management of fishers in Maine. Ph.D. Thesis, Syracuse Univ. 183 pp.

de Vos, A. 1951. Recent findings in fisher and marten ecology and management. Trans. 16th N. Amer. Wild. Conf. 16:498-507.

_____. 1952. Ecology and management of fisher and marten in Ontario. Ontario Dept. Lands and Forest Tech. Bull. 90 pp.

_____. 1957. Overflow and dispersal of marten and fisher from wildlife refuges. J. Wildl. Mgmt. 15(2):164-175

Dilworth, T.G. 1974. Status and distribution of fisher and marten in New Brunswick. Can. Field Nat. 88(4):495-498.

Dodds, D.G. and A.M. Martell. 1971. The recent status of the fisher, Martes pennanti pennanti (Erxleben), in Nova Scotia. Can. Field Nat. 85(1):62-65.

Eadie, W.R. and W.J. Hamilton. 1958. Reproduction in the fisher in New York. N.Y. Fish and Game J. 5(1):77-83.

Fogel, R. and J.M. Troppe. 1978. Fungus consumption (mycophagy) by small animals. Norhtwest Science. 52(1):1-31.

Grenfell, W.E. and M. Fasenfest. 1979. Winter food habits of fishers, Martes pennanti, in notherwestern California. Cal. Fish and Game. 65(3):186-189.

Grinnel, J., J.S. Dixon, and L.M. Linsdale. 1937. Furbearing mammals of California: Their natural history, systematic status and relations to man. Vol 1. Univ. of California Press. Berkeley. 375 pp.

Hamilton, W.J. and A.H. Cook. 1955. The biology and management of fisher in New York. N.Y. Fish and Game J. 2(1):13-35.

Hash, H.S. and M.G. Hornocker. c. 1978. Range and habitat of male fishers in northwest Montana. Idaho Coop. Wildl. Res. Unit Unpub. Manuscript 10 pp.

Hayne, D.W. 1949. Caluculation of size of home range. J. Mammal. 30(1):1-18.

Irvine, G.W., W. Magnus, L.T. Bradle and B.J. Bradle. 1964. Restocking of fisher in Lake States forests. Trans. 29th N. Amer. Wild. Conf. 29:307-315.

Kebbe, C.E. 1961. Transplanting fisher. Proc. 41st Ann. Conf. Wes. Assoc. State Game and Fish Comm. 41:165-167.

Kelly, G.M. 1977. Fisher (Martes pennanti)biology in the White Mountain National Forest and adjacent areas. Ph.D. Thesis, Univ. of Mass. 178 pp.

Mohr, C.O. 1947. Table of equivalent populations of North American small mammals. Amer. Midl. Nat. 37(1):223-49.

Morse, W.B. 1961. Return of the fisher. Amer. For. 67(4):24-26, 47.

Nie, N.H. et al. 1975. SPSS, Statistical package for the social sciences. MacGraw Hill Book Co., New York, Second Edition. 675 pp.

Parker, I. 1978. CALVEG. A classification of California vegetation. R-5 Regional Ecology Group. U.S. Forest Service. 168 pp.

Powell, R.A. 1977. Hunting behavior, ecological energetics and predator-prey communtiy stability of the fisher (Martes pennanti). Ph.D. Thesis, Univ. of Chicago. 132 pp.

Quick, H.W. 1953. Woverine, fisher and marten studies in a wilderness region. Trans. 18th N. Amer. Wild. Conf. 18:513-533.

Rand, A.L. 1944. The status of the Fisher (Martes pannanti) [Erxleben] in Canada. Canad. Field Nat. 58:77-81.

Sawyer, J.O. and D.A. Thornburgh. 1977. Montane and subalpine vegetation of the Klamath Mountains. pp. 699-732 in Bardour, M.G., and J. Major, eds. Terrestrial Vegetation of California. John Wiley and Sons, New York. 1,002 pp.

Schempf, P.F. and M. White. 1977. Status of six furbearer populations in the mountains of northern California. USDA For. Serv., Cal. Reg. 51 pp.

Weckworth, R.P., and P.L. Wright. 1968. Results of transplanting fishers in Montana. J. Wildl. Mgmt. 32(4):977-980.

Williams, R.M. 1963. Final segment report, trapping and transplanting. Part 1 - Fisher. Idaho Dept. Fish and Game.

Wright, P.L., and M.W. Coulter. 1967. Reproduction and growth in Maine fishers. J. Wildl. Mgmt. 31(1):70-87.

Yocom, C.F., and M.T. McCollum. 1973. Status of the fisher in Northern California, Oregon and Washington. Cal. Fish and Game. 59(4):305-309.

APPENDIX A

Fisher Study Field Data Form

FISHER STUDY FIELD DATA FORM

Species _____
Number _____
Date _____
Sedation Number _____

Sex _____
Total time of Immobilization _____
Time at First Obs. _____

Trapsite _____ Legal Location _____ Bait _____
District _____ Habitat _____

Collar Frequency _____ Collar Notes _____

Original Capture Location _____ Date _____
Recapture Location (1) _____ Date _____
(2) _____ Date _____

Condition/Behavior When First Observed _____

Condition/Position of Trap-Animal Sign _____

Immobilizing Drug(s) _____

Time of Injection	Dosage Rate	Dose(cc.)	Location of Inj.	Comment

Behavior/Response to Drug(s)

Time	Behavior			
1		6		
2		7		
3		8		
4		9		
5		10		

Markings/Color/Scars, etc. _____

Actual Wt. _____ gm Estimated Age _____ Total Length _____ mm Tail L _____ mm
Girth _____ mm Neck Circ _____ mm Head Circ _____ mm Head W _____ mm
Head L _____ mm Ear Notch _____ mm Nose Length _____ mm Nose W _____ mm
R.F. Toe W _____ mm R.F. Pad W _____ mm R.F. Pad L _____ mm
R.H. Toe W _____ mm R.H. Pad W _____ mm R.H. Pad L _____ mm R.H.Foot L _____ m

Previous Tag(s) Number _____ Installed _____ Removed _____

Pelage/Molting _____
Ectoparasites _____
Blood Sampled _____ Time _____
Reproductive Condition _____
Male Baculum Length _____ mm Rectal Temp. _____ Time _____
Location Released (If other than Capture Site) _____
Behavior Upon Release _____

Remarks, Etc. _____

APPENDIX B

Variables Used for Extensive Data Base and Definitions

APPENDIX B. Variables Used For Extensive Data Base And Definitions

Variable	Definition
1. Fisher number	Ear tag number of individual fisher
2. Location number	Number given to specific site where a fisher or fisher sign was located
3. Location type	Kind of location - trapsite, radio location/air, radio location/ground, track observation, den/rest site or visual observation
4. Sex	Sex of fisher - male or female
5. Age	Age of fisher - juvenile or adult
6. Day	Day fisher was located
7. Month	Month fisher was located
8. Year	Year fisher was located
9. Time	Time fisher was located
10. Elevation	Elevation of location to nearest 50 feet
11. Cloud cover	Percentage total cloud cover
12. Temperature	Approximate temperature
13. Precipitation	Type of precipitation - none, mist, light rain, heavy rain, light snow, heavy snow, hail
14. Wind	Approximate wind speed
15. Distance to 1° road	Map distance from location to nearest seasonally maintained forest road
16. Distance to 2° road	Map distance from location to nearest non-maintained road or four-wheel drive road

(See Appendix D for complete description of Variables 17-22)

17. Forest Service timber type classification	Timber type corresponding to each location
18. Dominant commercial species	Dominant species from timber type
19. Crown size	Crown size of timber type

APPENDIX B. (continued)

Variable	Definition
20. Crown cover	Crown cover of timber type
21. Label modifier	Label modifier for timber type

[a]All variables in the extensive data base are also contained in the intensive data base. See Appendix C for further explanation in the variables.

APPENDIX C

Fisher Study Habitat Analysis - Field Data Sheet and Key

Appendix C

FISHER STUDY HABITAT ANALYSIS - FIELD DATA SHEET

FISHER NUMBER ___ ___ (1 2) LOCATION NUMBER ___ ___ ___ (3 4 5)

Location Type ___ (6) If 4, snow depth ___ (7)

Location Date ___ ___ ___ ___ ___ (8 9 10 11 12)

Sex ___ (13) Time ___ ___ ___ ___ (14 15 16 17)

No. Locations at site ___ (18) Age ___ (19)

Data Collected by ___ (20)

Date Hab. Samp. ___ ___ ___ ___ (21 22 23 24)

Weather ___ - ___ - ___ - ___ (25 26 27 28)

Elevation ___ ___ ___ ___ (29 30 31 32)

Aspect ___ ___ ___ (33 34 35)

Slope ___ ___ (36 37)

Physiographic Position ___ (38)

Duff ___ (39) Litter ___ (40) Soil ___ (41)

Harvest Type ___ (42)

Plantation ___ (43) Snags ___ (44)

Leave Strip ___ (45) Burned ___ (46)

Nearest Distance to: (In meters)

CLEARCUT
1. Harvest .33
2. 0.33 - 1.5
3. >1.5

___ (47) - ___ (48)

Slashpile ___ (51)

Culldeck ___ (54)

1° Road ___ (57)

2° Road ___ (60)

3° Road ___ (63)

Freewater ___ (66)

Major Ridge ___ (69)

Minor Ridge ___ (72)

Ecotone ___ (75) 1 (80)

Card 2 - Autodup Cols 1 - 5

Rock Outcrop ___ (6)

Building ___ (9)

Leave Strip ___ (12)

Other ___ (15)

Plant Community ___ ___ (18 19)

Habitat Type ___ ___ (20 21)

Understory

Desc. Class ___ ___ - ___ ___ - ___ ___ (22 23 - 24 25 - 26 27)

Density ___ (28) Height ___ (29)

Slash ___ (30) Truffles ___ (31)

Riparian ___ (32)

Live Crown Percentage

Overstory ___ ___ (33 34)

Midstory ___ ___ (35 36)

% Crown Cover -

Overstory ___ (37)

Midstory ___ (38)

Total % Crown Cover ___ (39)

Ave. Height Overstory ___ (40)

Rest/Den Tree or Site

Species ___ (41)

Live, dead, partly dead ___ (42)

Height ___ (43)

DBH ___ (44)

Crown %age ___ ___ (45 46)

Top Condition ___ (47)

No. Cavities ___ (49)

Hard/Soft ___ (50)

Branches ___ ___ (51 52)

Bark Cover ___ (53)

Disease ___ (54)

Other (See verbal desc.) ___ (56)

Fisher No. ____ ____

FISHER STUDY HABITAT ANALYSIS - FIELD DATA SHEET - Page 2 Location No. ____ ____ ____

DOWNED WOODY MATERIAL

Large logs ____ (57)

Smaller logs ____ (58)

Large stumps ____ (59)

Smaller stumps ____ (60)

Bark/Twigs ____ (61) 2 (80)

Card 3 - Autodup Cols 1 - 5

BAF MEANS

	OVERSTORY		MIDSTORY		
DF	____ (6)	____	____	____ (9)	
WF	____ (10)	____	____	____ (13)	
RF	____ (14)	____	____	____ (17)	
IC	____ (18)	____	____	____ (21)	
JP	____ (22)	____	____	____ (25)	
PP	____ (26)	____	____	____ (29)	
SP	____ (30)	____	____	____ (33)	
KP	____ (34)	____	____	____ (37)	
LO	____ (38)	____	____	____ (41)	3 (80)

Card 4 - Autodup Cols 1 - 5

BO	____ (6)	____	____	____ (9)	
TO	____ (10)	____	____	____ (13)	
CH	____ (14)	____	____	____ (17)	
MAD	____ (18)	____	____	____ (21)	
PY	____ (22)	____	____	____ (25)	
DW	____ (26)	____	____	____ (29)	
ALD	____ (30)	____	____	____ (33)	
WLW	____ (34)	____	____	____ (37)	
OTHER	____ (38)	____	____	____ (41)	
OTHER	____ (42)	____	____	____ (45)	
TOTAL COUNT	____ (46)	____	____	____ (49)	4 (80)

Card 5 - Autodup Cols 1 - 5

Ave. DBH (in inches)

	OVERSTORY	MIDSTORY	
DF	____ (6)	____ (7)	
WF	____ (8)	____ (9)	
RF	____ (10)	____ (11)	
IC	____ (12)	____ (13)	
JP	____ (14)	____ (15)	
PP	____ (16)	____ (17)	
SP	____ (18)	____ (19)	
KP	____ (20)	____ (21)	
LO	____ (22)	____ (23)	
BO	____ (24)	____ (25)	
TO	____ (26)	____ (27)	
CH	____ (28)	____ (29)	
MAD	____ (30)	____ (31)	
PY	____ (32)	____ (33)	
DW	____ (34)	____ (35)	
ALD	____ (36)	____ (37)	
WLW	____ (38)	____ (39)	
OTHER	____ (40)	____ (41)	
OTHER	____ (42)	____ (43)	
TOTAL AVE.	____ (44)	____ (45)	5 (80)

LEGAL LOCATION AND DRAINAGE.

DOWNED WOODY MATERIAL

MINIMUM LOG LENGTH - 1.5 METERS

	1	2	3	4	5
LARGE LOGS > 1m. dia.	0 LOGS	1-3	4-7	8-11	>11 LOGS
Smaller logs 1dm.-1m. dia.	0 LOGS	1-10	11-20	21-30	>30 LOGS
LARGE STUMPS > 1m. dia.	0 STUMPS	1-5	6-10	11-15	>15
Smaller STUMPS < 1m. dia.	0 STUMPS	1-5	6-10	11-15	>15
BARK/TWIGS	0%	1-25%	26-50%	51-75%	>75%
enter	1	2	3	4	5

BAF OVERSTORY

SPECIES	1	2	3	4	5		$\bar{X}$
DF							
WF							
RF							
IC							
JP							
SP							
PP							
KP							
LO							
BO							
TO							
CH							
MAD							
PY							
OTHER							
TOTAL COUNT							

BAF MIDSTORY

SPECIES	1	2	3	4	5		$\bar{X}$
DF							
WF							
RF							
IC							
JP							
SP							
PP							
KP							
LO							
BO							
TO							
CH							
MAD							
PY							
OTHER							
TOTAL COUNT							

Location No. _____ P. T

OVERSTORY – SPP., STOCKING, ETC.

MIDSTORY – SPP., STOCKING, ETC.

BRUSH/SHRUB/HERB LAYER – SPP., DENSITY, ETC.

OTHER – FOREST OPENINGS, SOIL CHAR., MOSSES, FEEDING HOLES, ETC.

APPENDIX C. Key to Habitat Analysis Field Data Sheet.

The following are definitions and explanations of variables recorded on the Habitat Analysis Form used for each intensively analyzed fisher location. They are presented in the order that they appear on the form.

Page One of Form

1-2. Fisher Number - unique ear tag number for each fisher captured.

3-5. Location Number - number given to a specific site where a fisher or positive fisher sign was located. Multiple locations at one site have different numbers.

6. Location Type - 1. Trapsite
2. Radio Location - Ground
3. Radio Location - Air
4. Track
5. Visual Observation or Den/Rest Site
6. Other

7. Depth of Snow - depth of snow, in centimeters, if location type is a snow track.

8-12. Location Date - date fisher was located.

13. Sex - male or female

14-17. Time - time of observation.

18. Number of locations at this site - self-explanatory

19. Age - adult one year or older, juvenile less than one year. Age determination by saggital crest development, tooth wear and body weight at time of capture.

20. Data Collected By - 1. Slader Buck
2. Curt Mullis
3. Other

21-24. Date habitat sampled - self-explanatory

25-28. Weather - taken at point of observation, not at fisher location.

Cloud Cover - 1. 0-20%
2. 21-40%
3. 41-60%
4. 61-80%
5. Greater Than 80%

Temperature - 1. Less Than 32°F
2. 33-50°F
3. 51-80°F
4. Greater Than 80°F

Precipitation - 1. None
2. Mist
3. Light rain
4. Heavy rain
5. Light snow
6. Heavy snow
7. Hail

Wind - 1. None
2. Less Than or Equal to 10 mph W
3. Greater Than 10 mph W
4. Less Than or Equal to 10 mph E
5. Greater Than 10 mph E
6. Less Than or Equal to 10 mph N
7. Greater Than 10 mph N
8. Less Than or Equal to 10 mph S
9. Greater Than 10 mph S

29-32. Elevation - from USFS blueline maps or USGS topographic quadrangle maps.

33-35. Aspect - expressed in degrees, of a 360° compass.

36-37. Slope - expressed in degrees, using clinometer or Relaskop.

38. Physiographic Position - 1. Ridgetop
2. Upper Slope
3. Mid Slope
4. Lower Slope
5. Bottom or Draw
6. Exposed Flat
7. Shaded Flat
8. Broken/Rolling

39. Duff - depth in cm of decomposing leaves, bark, etc.

1. 1 cm
2. 2 cm
3. 3 cm
4. 4 cm
5. 5 cm
6. 6 cm
7. 7 cm
8. 8 cm
9. 9 cm or more

40. Litter - average depth of small twigs, bark, and leaves.

1. No litter
2. 1 - 5 cm
3. 6 - 10 cm
4. 11 - 15 cm
5. 16 - 20 cm
6. Greater than 20 cm

41. Soil - not sampled.

42. Harvest Type - 1. The fisher location occurred in an area which has not had timber harvested. 2. The location occurs in an area that has been clear cut. Regeneration may be in any stage. 3. The location occurs in any type of select cut.

43. Plantation - A "1" was entered if location occurred in a plantation, and an "0" if it did not.

44. Snags - dead, standing trees, at least 15 cm in diameter and at least one m high; may or may not have branches.

45. Leave strip - size of nearest leave strip less than 300 meters away. A leave strip is defined as a "strip" of timber left uncut between two clear cut areas.

1. Equal to or less than 10 m wide
2. 11 - 25 m wide
3. 26 - 50 m wide
4. 51 - 75 m wide
5. 76 - 100 m wide
6. Greater than 100 m wide

46. Burned - 1. No visible evidence of burning
2. Visible evidence of burning.

Nearest distance to: (in meters). Estimated distances to the following variables. (Distance categories listed first).

Distances - 1. 0 - 50 m
2. 51 - 100 m
3. 101 - 150 m
4. 151 - 200 m
6. 201 - 250 m
7. 251 - 300 m
8. Greater Than 300 m

47. Distance to Nearest Clearcut.

48. Clearcut - Vegetation height

1. Harvest - 0.3 m
2. 0.3 - 1.5 m
3. Greater than 1.5 m

51. Slashpile/Downed woody material - hand piled of "natural" accumulation.

54. Culldeck - stacked cull logs.

57. Primary (1^{o}) Road - Maintained road, passable with two-wheel-drive vehicle under normal conditions.

60. Secondary (2^{o}) Road - Marginal two-wheel-drive road under normal conditions, usually requires four-wheel-drive.

63. Tertiary (3^{o}) Road - Old logging roads and skid trails which have been blocked off. Vegetation may be present on road bed.

66. Free Water - available at least six months of the year (estimate).

69. Major Ridge - ridge which separates any two mapped (USGS or USFS 4 in/mi) tributaries and/or drainages.

72. Minor Ridge - lateral ridge off of a major ridge.

75. Ecotone - "Boundary" between two plant communities.

6. Rock outcrop - nearest obvious outcrop.

9. Building - must be standing, need not be inhabited.

12. Leave Strip - strip of timber, usually on ridge, left between two clear cuts.

15. Other - anything possibly significant, see verbal description on Habitat Analysis Form.

18-19. Plant Community - Plant community descriptions are mainly from Parker (1978). (CALVEG. A Classification of California Vegetation) We classified plant communities at fisher locations using the North Coast Ecological province section. For our area we found it necessary to identify three plant communities not described in Parker. These are numbers 3, 6 and 19.

1. Douglas-Fir - Tan Oak - Madrone
2. Douglas-Fir - Pine - Madrone
3. Douglas-Fir - Live Oak - Chinquapin
   Douglas-fir dominant in overstory. White fir may be present, Ponderosa pine present on drier sites. Live oak, Chinquapin or madrone understory or mid-story. Live oak often dominant in under-mid-story.
4. Mixed Conifer - Fir
5. White Fir
6. White Fir - Madrone
   White fir dominant overstory. Douglas-fir may be present. Midstory usually madrone, but may be Black oak, Chinquapin, or Live oak or combination.
7. Jeffrey Pine
8. Mixed Conifer - Pine
9. Knobcone Pine
10. Ponderosa Pine
11. Tan Oak - Madrone
12. Canyon Live Oak
13. Black Oak
14. Maple

18-19. Plant Community (continued)

15. Montane Mixed Shrub
16. Ceanothus
17. Mixed Shrub
18. Other
19. Red Fir/Douglas-Fir
    Red fir and Douglas-fir dominant in both overstory and midstory. Sugar pine present in varying amounts. May be associated with meadow areas and/or brush fields with grasses, Prunus, Arctostaphylos, etc.

20-21. Habitat Type - Habitat type descriptions are from Parker (1978), slightly modified as follows:

1. Grass-Forb Stage - Consists of annual and perennial grasses and forbs, with or without scattered shrubs and seedlings to 45.7 cm (18 in) high.
2. Shrub-Seedling-Sapling Stage - Mixed or pure stands of shrubs, tree seedlings and tree saplings up to about 6.0 m (20 ft) in height.
   Pole-Medium Tree Stage - This stage includes larger trees in the ranges of 6.1-15.2 cm (20-50 ft).
3. 40% crown cover, typically a substantial shrub understory.
4. Crown closure 40-70%, typically with varying amounts of shrub understory.
5. 70% crown closure, typically lacking any appreciable amounts of understory vegetation.
   Large Tree Stage - This stage corresponds roughly to the mature and old stand classifications of forestors. Trees generally exceed 50 ft.
6. 40% crown closure, typically a substantial shrub understory.
7. Crown closure 40-70%, typically with varying amounts of shrub understory.
8. 70% crown closure, typically lacking any appreciable amounts of understory.

9. Wetland Association - Includes marsh areas and meadows which contain standing water at least six months of the year.
10. Barren - Roads, quarries, etc.
11. Clearcut - Includes cut stages from recently cut and logged, through regeneration preparation, to stage 2, above.
12. YUM Yards (Yarded Unutilized Material) - Log landings.
13. Riparian areas - Includes mixed herbs, shrubs, and trees along riparian corridors.

22-27. Understory Descriptive Class - We used common understory plants and plant groups of the subareas to characterize understory vegetation. The most noticeable plant or group was entered first, the second most prominent was entered second, etc. If no more than one plant species or plant group was abundant, nothing was entered in the latter cases.

Common understory species or plant groups occurring in the study area are listed below:

Understory - Descriptive Classes

01. Ceanothus cordulatus (Mountain Whitethorn)
02. C. integerrimus (Deer Brush)
03. C. velutinous (Tobacco Brush)
04. C. prostratus (Mahala Brush)
05. Symphoricarpos (Snowberry)
06. Ribes (Current, Gooseberry)
07. Rubus (Blackberry, Raspberry, etc.)
08. Sambucus (Elderberry)
09. Salix (Willow)
10. Corylus (Hazel)
11. Alnus (Alder)
12. Physocarpus (Ninebark)
13. Berberis (Barberry)
14. Vancouveria
15. Vaccinium (Huckleberry)
16. Rosa (Rose)
17. Chimaphila (Pipsissewa)
18. Pirola (Wintergreen)
19. Acer (Maple)
20. Pinus ponderosa (Ponderosa Pine)
21. Pseudotsuga menziesii (Douglas-Fir)
22. Arbutus menziesii (Pacific Madrone)
23. Castanopsis (Chinquapin)
24. Calocedrus decurrens (Incense Cedar)
25. Quercus kelloggii (California Black Oak)
26. Quercus chrysolepis (Maul Oak, Canyon Live Oak)
27. Arctostaphylos (Manzanita)
28. Cornus (Dogwood)
29. Ferns
30. Grass (various sp.)
31. Other herb
32. Other shrub
33. Other tree
34. Toxicodendron (Poison Oak)
35. Abies concolor (White Fir)
36. Mixed

28. Average Density of Understory Vegetation - Recorded as simple percent of the ground over which vegetation occurs, in 20 percent increment classes given numbers one through five.

29. Average height of understory species -
1. 1 - 30 cm
2. 31 - 60 cm
3. 0.6 - 1.5 m
4. 1.5 - 3.0 m
5. Greater Than 3 m

30. Slash - We defined slash as downed, dead, woody material with a diameter between one and 15 cm and a length of 30 cm or greater. Slash may be hand piled or a natural accumulation. Slash data were recorded in the following categories.
1. Scattered, less than 0.5 m high
2. Scattered, greater than 0.5 m high
3. Dense, less than 0.5 m high
4. Dense, greater than 0.5 high

31. Truffles - False truffles (Rhizopogon spp.) were found by Grenfell and Fasenfest (1979) to possibly be an important food item for fishers in Trinity County (Grenfell, W. E. and M. Fasenfest. 1979. Winter food habits of fishers, Martes pennanti, in northwestern California. Cal. Fish and Game 65(3):186-189).
We attempted to record presence or absence of an indicator of false truffles at each fisher location that we sampled. According to Dr. David Largent (Dept. of Biology, Humboldt State Univ., Arcata, Ca. 95521, pers. comm.), one indicator of the presence of false truffles is the "digging up" of duff and litter by various animals, including rodents, fishers, skunks, and deer in their search for the false truffles. False truffles are hypogeous fungi which emerge after rains. "Digs" under the base of trees usually indicate the presence of these fungi, so we recorded the presence or absence of such "digs."
These data were recorded in the following manner:
1. Present
2. Absent
3. Indicator present
4. No indicator

32. Riparian - We used three broad descriptive categories to record major vegetation species and width of riparian corridors at locations in riparian zones.
1. Grass-Forb-Meadow - Wide corridor greater than 10 m
2. Willow-Alder-Hazel - Medium corridor 5-10 m
3. Little understory vegetation - Narrow corridor less than 5 m.

33-36. Live Crown Percentage - Recorded as the average percentage of length of the bole which contributes live branches to the crown of the tree for overstory and midstory species.

37-38. Percent Crown Cover - The estimated sum of percent crown cover in 20 percent increment classes for all tree species at each fisher location sampled. Percent crown cover was recorded as:

1. 0 - 20%
2. 21 - 40%
3. 41-60%
4. 61 - 80%
5. 81 -100%

39. Total Percent Crown Cover - Use same classes as Percent Crown Cover.

40. Average Height Overstory - Estimated for all overstory trees near each fisher location:

1. 15 - 24'
2. 25 - 34 '
3. 35 - 49'
4. 50 - 64'
5. 65 - 79'
6. 80 - 99'
7. 100 - 134'
8. 135 - 169'
9. 170'

Den/Rest Site. Eleven variables were recorded at each location where a fisher was located in a den or rest site. These variables apply to the specific location (tree or log pile) where the fisher occurred.

41. Species - 1. Douglas-fir, 2. True fir, 3. Incense cedar, 4. Pine, 5. Black oak, 6. Live oak, 7. Madrone, 8. Chinquapin, 9. Other

42. Live-Dead-Partly Dead - 1. Live, 2. Dead, 3. Partly Dead

43. Height - Use same classes as Ave. Height Overstory, above.

44. DBH - 1. 4 - 7", 2. 8 - 12", 3. 13 - 18", 4. 19 - 28", 5. 29 - 43", 6. 44 - 63", 7. Equal to or greater than 64"

45-46. Crown Percentage - Same definition as "Live Crown percentage," numbers 33-36.

47. Top Condition - 1. Undamaged, 2. Broken, 3. Spike, 4. Split, 5. Unable to Determine

49. No. of Cavities - 1. None, 2. Cannot be determined, 3. 1-5, 4. 6-9, 5. Greater Than 9

50. Hard-Soft - 1. Hard (not rotten)
2. Soft (rotten, puncky)
3. Combination, hard at base, soft above.

51-52. Branches -

First Column

1. All intact
2. Many; fine branches gone
3. Few; medium and large only
4. Stubs only
5. None

Second Column

1. Most in upper 1/3 of canopy
2. Most of middle 1/3 of canopy
3. Most in lower 1/3 of canopy
4. Evenly distributed along canopy

53. Bark Cover - 1. Bark covers 100% of tree
2. 80-99%
3. 50-79%
4. 20-49%
5. 0-19%

54. Disease/Damage - 1. None
2. Fungus present
3. Conk
4. Sap exuding
5. Insect damage
6. Fire damage
7. Other

56. Other - In the verbal description section, we recorded any other pertinent data not covered by the above variables.

Page Two of Form. Downed woody material - (defined in the box at top of page 3 in the Habitat Analysis Form) were recorded at each location sampled.

57. Large Logs

58. Small Logs

59. Large Stumps

60. Small Stumps

61. Bark/Twigs were recorded in percent ground cover categories. These data were first recorded at the upper right of page 3 of the form and later transcribed to spaces 57-60 of page 2. The numbers 1 to 5 were used as indicated below the box on page 3.

Tree species definitions used on pages 2 and 3 of Habitat Analysis Form:

DF	Douglas-Fir	BO	Black Oak
WF	White Fir	TO	Tan Oak
RF	Red Fir	CH	Chinquapin
IC	Incense Cedar	MAD	Madrone
JP	Jeffrey Pine	PY	Pacific Yew
PP	Ponderosa Pine	DW	Dogwood
SP	Sugar Pine	AL	Alder
KP	Knobcone Pine	WLW	Willow
LO	Live Oak		

6-41 & 6-49. BAF MEANS - This refers to means of the basal area factors for each species. Basal area was recorded in square feet per acre for all species in the overstory and midstory at each location sampled. We used a Relaskop for this measurement. The raw data were recorded on page 3 and the means were calculated and transferred to page 2 of the form, then basal area was calculated by the SPSS computer program.

6-45. Diameter Breast Height - We recorded an ocular estimate of DBH for all species in the midstory and overstory at each location sampled. We used the following categories.

1.	4-7"	5.	29-43"
2.	8-12"	6.	44-63"
3.	13-18"	7.	Greater Than 64"
4.	19-28"		

Page Three of Form. Page 3 was used as a worksheet for data entered on page 2. These data were for downed woody materials and BAF means.

Page Four of Form. Page 4 was used for brief verbal descriptions of broad vegetative classes within each plot and to record anything that appeared important that was not covered on pages 1 and 2.

APPENDIX D

Timber Types Found Within the Study Area and Key

APPENDIX D. Timber Types Found Within the Study Area.

Timber Type Group	Common to Both Subareas	Found Only In CBSA	Found Only In HBSA
Open Areas (n=7)	SM/C GL	UX/C HL/C HC/C NB	UX
Brush/Shrub (n=11)	SM SA KP PP1N/P PP2G/P	PPDF6G/P PP1P/SM JPDP4S/SM SR	PP1G/P PPDF1G/P PP6G/P WF1P/SM
Hardwoods (n=4)	HW HL	HM HC	
Old Growth Conifer (n=23)	DF3G DF3N DF4G DF4N DFWF3G DFWF3N DFWF4G DFPP3N PPDF6G WFDF3G	DF6G PPDF3N CX3N	DFPP3G DFSP3G DFSP3N DFSP4G WF3G WF3N WF4G WFDF3N WFDF4G PPWF3N
Mixed Conifer/ Hardwood (n=18)	DF3P/CH DF3P/NH DF3S/CH DF3S/NH DFWF3P/NH DFWF3S/NH DFPP3P/NH PPDF3P/NH PPDF3S/NH	DFWF3S/CH DFPP3P/CH DFPP3S/NH PPDF3 /NH DFKP3S/NH WFDF3P/NH	DFSP3S/NH DFSP3P/NH
Mixed Conifer/ Shrub (n=17)	DFWF3P/SM PP2S/SM DFWF3P/SM	DF3S/SX DF3P/SM DFWF3S/SM DFPP3P/SM DFPP3S/SM PPDF3P/SM PPDF3S/SM JPDF4S/SM	DF3P/SA DFPP3P/SA PPDF3P/SA WF3P/SM WF3S/SM WFDF3P/SM DF3S/SA WF2P/SA

APPENDIX D. Timber Types Found Within the Study Area (Continued).

Timber Type Group	Common To Both Subareas	Found Only In CBSA	Found Only In HBSA
Mixed Conifer/ Open (n=7)		DFWF3P/NG DFWF3P/NV DFPP3P/NG DFPP3P/NV DF2S/NG	DF2P/NG WFDF3P/NV
Small Conifer/ Conifer Non-Commercial (n=9)	DF2G DF2N DFPP2N PP2N WF2G		DF1G DF3P/NC WFDF2G WF2N
Small Conifer/ Hardwood (n=5)	DF2S/NH PP2P/NH	DF2P/NH DFPP2P/CH	DFPP2P/NH
Conifer/Riparian (n=3)	DFWF3P/SR		WF3P/SR ~~SR~~
Unlabeled (n=1)	Yes		
Total[1]	30/8	33/37	33

[1]Total timber types for both subareas = 103

APPENDIX D. Shasta-Trinity National Forest Timber Types--Key.

Sequence of Labels. Labels shall always be in the following sequence: tree species or vegetation, size class, and crown density. The following tables list all of the acceptable symbols and define all of the acceptable labels that can be constructed with this symbol.

1. Forest

(A) - Non-Commercial Conifers

KP Knobcone Pine
DP Digger Pine
FP Foxtail Pine
PJ Pinyon-Juniper
WB Whitebark Pine

(B) - Commercial Conifers

PP Jeffrey Pine or Ponderosa Pine
SP Sugar Pine
WP Western White Pine
LP Lodgepole Pine
WF White Fir
RF Red Fir
DF Douglas fir
IC Incense Cedar
PC Port Oxford Cedar
MH Mountain Hemlock
BS Brewer Spruce
CX Mixed Commerical Conifers

(C) - Commercial Hardwoods

HM Pacific Madrone
HB Black Oak
HC Mixed Commercial Hardwoods - Miscellaneous Commercial Hardwoods, no single commercial hardwood makes up>80% of the area occupied by trees.

(D) - Non-Commercial Hardwoods

HF Live Oak - Average shown height greater than 15'
HS Big Leaf Maple
HW Oregon White Oak

APPENDIX D. Shasta-Trinity National Forest Timber Types--Key (Continued).

2. Non-Forest

(A) - Non-Woody Vegetation

GL Grass
GH Herbacious Cover

(B) - Shrubs

SB Sagebrush
SA Chaparral - Manzanita and associated shrubs.
SC Chamise - Adenostoma and associated shrubs.
SM Montane - Buckbrush, Chokecheery, Whitethorn, etc.
SR Streamside - Wet meadow or Bog Shrubs and Cottonwood, Alder, Willow.
SX Miscellaneous Shrubs - Bitterbursh, Mountain Mahogany, etc.
SH Shrub Size Hardwoods - Tan Oak, Brewer Oak, and Live Oak, average height less than 15'.

(C) - Non-Vegetated

NB Barren - Rocks.
NW Water - Lakes, permanent snowfields.
ND Urban Developed - Settlements, quarries, roads.
UX Clearcuts/Type Conversions - No vegetation visible.
FB Recent Fire
CL Cultivated - Farms, orchards.

Size Class Labeling. (1) Size class codes are based only on the crown diameter of the commercial conifers present in the polygon and, except for two-storied stands (See 2 following), are classified according to the predominant size class of commercial species in the crown area. (2) Two-storied stands (Code 6 and 7) are defined as stands of commercial conifers with an overstory of Size Class 4 or 5 and an understory at least two size classes smaller. Overstory density must not exceed 20 percent, and the total projected density of the understory to small timber size must be over 70 percent.

are not visible in a quantity that will occupy 10 percent of the area. (2) If a polygon is classed commercial conifer and is obviously the result of planting, code /P after the Density Code. (3) If a polygon has been classed commercial conifer and the Density Code is S or P, code the following after the Density Code if that condition represents most of the area not occupied by conifers:

/CH	Commercial Hardwoods
/NH	Non-Commercial Hardwoods
/NS	Rock, Water or Urban Developed
/NV	Recent Burned, Site Prepared (Bare Soil)
/NG	Herbs or Grass
/SB	Sagebrush
/SA	Chaparral
/SC	Chamise
/SM	Montane
/SR	Streamside
/SX	Miscellaneous Shrubs
/NC	Non-Commercial Conifers
/C	Clearcut
/P	Plantation

APPENDIX E

Individual Fisher Accounts

APPENDIX E. Individual Fisher Accounts.

INDIVIDUAL FISHER ACCOUNTS

Corral Bottom Subarea

Fisher No. 04

Fisher No. 04, an adult female, was captured on 16 November 1977, in the Corral Bottom subarea below Pattison Peak, approximately 1/4 mi (0.4 km) above the terminus of road 33N60-E.

She was transported to Lewiston, California the morning following her capture for immobilization in the presence of a representative of the California Department of Fish and Game. The initial drug dose was inadequate. She retained most of her muscle control and removed the telemetry collar almost immediately by slipping it over her head. A second immobilization was carried out the same evening at Big Bar and she was successfully collared with a 110 g collar.

Closer examination while she was under immobilization revealed that she was at least five years old. She had meager sagittal crest development, but her lower premolars were missing and very little of her heavily worn molars appeared above the gum line. She was missing one incisor (I3) and showed evidence of two past injuries; a lip/gum cut on the lower left side of her mouth and an irregularly shaped tongue. Her weight was 4.0 lbs (1.8 kg). She was released on the morning of 18 November at the point where she was captured.

On 31 January 1978, over two months after her release, Fisher No. 04 was observed crossing the Corral Bottom road by an employee of Big Bar Ranger Station. The following morning she was recaptured on Bidden Creek, approximately 2 miles (3.20 km) from where she was observed

the previous day. At that time she was inspected and weighed while in the trap. Weight, calculated by difference, was 3.8 lbs (1.71 kg). This is believed to be a near accurate measurement. (Constant movement of the animal inside the trap made exact weight determination of the unimmobilized fisher impossible under field conditions.) Pelage was in prime condition. The ear tag and telemetry collar appeared normal and she appeared to be in good health.

The next contact with Fisher No. 04 was received on 8 February in Corral Bottom, a linear distance of three miles (4.8 km) from the recapture site. After obtaining three successive signals from the same location, we investigated on 11 February and found her lying on the ground, dead.

The carcass was sent to the CDF&G Wildlife Investigations Laboratory in Sacramento for autopsy. An autopsy was done but we received no written confirmation of the results. Personal communications with CDF&G employees at the Wildlife Investigations Laboratory indicate that Fisher 04 was carrying very little fat when she died. She was not pregnant or in estrus at the time of death.

From the ten locations obtained for Fisher 04 she appears to have had a minimum individual range of 2.64 mi^2 (6.84 km^2) restricted to the Corral Bottom area north of Pattison Peak. Her elevational range was between 2700' (823.0 m) and 3850' (1173.5 m).

Fisher No. 05.

This fisher, a male weighing 7.5 lbs (3.4 kg), was captured on 18 November 1977 above Haypress Meadow on the ridge which separates

the two subareas. This was the second capture at this location: a large fisher was captured there on 15 May 1977, while exploratory trapping was being conducted. No attempt was made to immobilize, handle, or mark that fisher. It is possible that Fisher 05 is the same inidividual that was caught on 15 May 1977.

Since Fisher 05 was first observed late in the afternoon of 18 November we decided to leave him in the trap and conduct immobilization the following day under better lighting conditions. The trap was covered with a wool blanket, then secured to its adjacent log with an additional cable and cable clamp. Three 6 oz. cans of tuna cat food, one apple and 1/8 jar strawberry jam was left in the trap as food. On 19 November when we returned the fisher was calm and had eaten all the food. Small parts of the blanket had been pulled into the trap and it was well shredded below the trap.

Fisher 05 was immobilized at the trapsite. He had no obvious scars or injuries and was estimated to be between three and four years old. He was collared with a 110 g radio collar, then placed back in the trap and allowed to recover while we went to check the remainder of our trapline. He was released at dusk and ran quickly out of the trap, downhill and then up a tree.

On 10 February 1978 Fisher 05 was recaptured at trapsite No. 3, near upper Corral Creek, a distance of 1 mi (1.6 km) from his initial capture location. He was inspected in the trap and then released.

We obtained 49 locations on Fisher 05 before his body was recovered on 7 October 1978 below a log pile in an opening adjacent to forest road 4N08 in upper Haypress Meadows. The last signal prior to recovery was on

APPENDIX E (Continued).

15 September. When discovered, Fisher 05 was lying spread-eagled, indicating he may have fallen from the top of the pile. There was a series of 1 1/2" (3.8 cm) long fresh claw marks on a log directly above where the fisher was found but we were unable to determine if these were made by Fisher 05.

An autopsy was conducted at Humboldt State University, but the exact cause of death could not be determined (Appendix E). Close examination of the skull showed that since his initial capture he had broken off both the tip of his left upper canine and the third lower pre-molar on the left side.

The individual range of Fisher 05 was concentrated in upper Corral Creek and the upper portion of Miners Creek. Fisher 05 appeared to overlap the southernmost portion of the range of Fisher 27 another adult male. The elevational range of Fisher 05 was between 3400' (1036 m) and 4650' (1417 m).

Fisher No. 06

Fisher 06, a juvenile female, was captured on 18 November 1977 at the extreme upper end of West Hayshed Creek. She was taken to Big Bar for immobilization, fitted with a 110 g collar and released on the morning of 20 November at the trapsite.

On 27 November we obtained a location 2 mi (3.2 km) from her capture/release site. On 9 December, after receiving three consecutive triangulations from the same area, we investigated and recovered her from inside a rotted stump in Panther Creek, approximately 3 1/4 mi (5.2 km) from her capture site. She had dug herself deep into the soft interior of the stump and it was necessary to tear the stump apart to reach her.

The carcass was sent to the CDF&G Wildlife Investigations Laboratory in Sacramento for autopsy. Results (Appendix E) indicate she died as a result of an encounter with another animal, possibly another fisher.

The three locations obtained from Fisher 06 indicate that she was moving out of the study area in a northeasterly direction. She may have been wandering in search of a permanent range.

Skin and skeletal remains from Fishers 04 and 06 were placed in the freezer at the CDF&G Wildlife Investigations Laboratory. However, these were subsequently misplaced when the freezer later broke down. Therefore, we were unable to obtain skeletal materials for positive age determination of these fishers.

Fisher No. 27

Fisher 27, a 9.0 lb (4.1 kg) adult male was captured at the extreme southern edge of his range on 11 February 1978. His capture was within 24 hours after a recapture of Fisher 05 at the same trapsite. Inspection under immobilization revealed that he was missing two lower incisors and had abrasions on his gums above both upper canines. He was fitted with a 110 g collar and released on a forest road approximately 200 yds (183 m) below his capture location.

We obtained 83 locations on Fisher 27, the greatest number of locations for any fisher in our study, before he was recovered dead from Upper Price Creek on 17 February 1979. When he was recovered, his body was lyi free on the ground. Fisher 27 was autopsied at Humboldt State University, but we were unable to ascertain the exact cause of death (Appendix E). Inspection of his skull showed that since his initial capture he had lost two

additional incisors and the first and second premolars on each side of his lower jaw.

The individual range of Fisher 27 was 4.78 mi^2 (12.38 km^2) and was centered around Mud Springs at the eastern end of Corral Bottom. His movements showed a pattern of frequent use of the larger riparian areas within his range (see Results-Individual Range and Movement). The lowest elevation recorded for Fisher 27 was 2650' (808 m) and the highest was 4150 (1265 m).

At least 10 attempts were made to locate Fisher 27 at a den/rest site. Ground telemetry on foot was tried at two specific locations where Fisher 27 regularly occurred. On every occation he would begin moving out of the area when we approached within an estimated 100' (30 m) of his location. On one occasion when we pursued him with hounds he followed a dense riparian corridor in order to evade our pursuit. We were able to outdistance him by moving along the more open upland areas but we were still unable to make visual contact due to the density of the riparian vegetation.

Fisher No. 10

This fisher, a one year old adult male weighing 7.3 lbs (3.3 kg), was initially captured on Bidden creek, just north of Corral Bottom road on 8 March 1978. He was fitted with a 110 g collar and released the date he was captured.

A single bearing from Fisher 10 was obtained the day after his release. Subsequent monitoring in widening circles from the capture location by vehicle and from aircraft failed to obtain a signal from this fisher.

APPENDIX E (Continued).

On 22 March 1979 Fisher 10 was recaptured on Corral Creek, approximately 1 mi (1.6 km) from his initial capture location. He was still wearing the telemetry collar and appeared in excellent health. He was immobilized near his recapture location and fitted with another 110 g collar. When the used collar was removed, the fur beneath appeared matted but there was no evidence of chafing or injury caused by the collar. His weight was 8.0 lbs (3.6 kg) and his left upper canine was chipped. Although Fisher 10 had gained weight and all measurements had increased proportionally, palpation of the sagittal crest showed that its development was still at the "button" stage.

The used telemetry collar had numerous small dents in the canister and small nicks in the collar material. It was returned to Telonics, Inc. and they informed us that the transmitting crystal had been shattered. Shortly after release the canister had evidently taken a strong jolt that shattered the crystal causing the malfunction.

After his release on 22 March, we obtained 14 additional locations and established his 8.48 mi^2 (22.96 km^2) individual range to be within the northeastern Corral Bottom-Monument Peak-upper Price Creek area. The range of Fisher 10 was the largest range within the Corral Bottom subarea. It encompasses an elevational spread from 2,000' (610 m) to 4,000' (1219 m).

The range of Fisher 10 overlapped the mapped range of Fisher 27, another adult male. Although both were alive between February 1978 and mid-February 1979 when Fisher 27 died, the malfunction of the collar on Fisher 10 prevented us from determining whether or not their ranges overlapped during that period.

We monitored the movements of Fisher 10 until 26 June 1979 when

APPENDIX E (Continued).

Craig Coolahan took charge of recording fisher movements within the study area. During that time in addition to several other locations, Fisher 10 was located twice in a den/rest tree and was observed once as he moved through a mixed conifer/hardwood area in the middle of Corral Bottom.

Fisher No. 14

Fisher 14, one of two 10.1 lb (4.6 kg) adult males captured in the Corral Bottom subarea, was trapped on 17 March 1978 at the same trapsite where Fisher 04, an adult female, was initially captured on 16 November 1977. When first observed his nose was slightly bloodied from attempting to escape the trap.

Fisher 14 was estimated to be at least five years old. He was missing his right lower canine and had chipped his left lower and right upper canines; all were old injuries. He was collared with a 110 g collar and released at the trapsite on the date of his capture. The large size of his neck (230 mm) necessitated punching additional holes in the collar material to allow it to be fitted properly.

After his release we made repeated unsuccessful attempts to locate him. Even an aerial search proved fruitless. Finally on 27 July 1978 we located him on the east slope of Underwood Mountain, 6.8 mi (10.9 km) from his capture/release site. From late July 1978 until early April 1979 we obtained 12 additional locations and established his 6.78 mi^2 (10.9 km^2) range over the southern portion of Underwood Mountain, the upper portion of Buckeye Creek and the middle of Allen Creek.

The long distance from Big Bar, relatively poor vehicle access and rugged topography of his range restricted ground telemetry efforts. Eleven of the 13 locations we recorded between 27 July 1978 and 8 April 1979

were obtained from aircraft. Fisher 14 was located once in a log pile near Eltapom Creek (see Den/Rest Site Descriptions) and unsuccessfully pursued once into Buckeye Creek. The elevational range within his individual range was 2900' (884 m) to 4250' (1295 m).

The distance from his capture location to the closest edge of his individual range was 4.2 mi (6.8 km). Fisher 14 showed no indication of moving back toward the Corral Bottom subarea during the time we monitored his movements. Therefore, we believe that his capture in Corral Bottom was related to his increased movement during breeding season. If his initial capture location were considered as part of his individual range, his individual range would be increased to 11.8 mi^2 (30.5 km^2).

Fisher No. 02

Fisher 02, a juvenile male, was captured on 29 November 1978 at the same trapsite where Fisher 05, an adult male was captured on 18 November 1977. Fisher 02's capture was the third at this location. During immobilization we discovered that prior to capture he had sustained a serious injury which prevented him from completely closing his mouth. The gum tissue surrounding the anterior portion of his lower jaw was enlarged and swollen giving the entire lower jaw the appearance of being malformed. His right lower canine had only partially erupted and there was no evidence of a left lower canine. The dirty coloration of the canines present and the overall appearance of the mouth indicated that this injury was not recent.

Due to the fact that Fisher 02 was immobilized we were unable to tell to what degree, if any, this condition caused the fisher discomfort.

Although this condition was certainly detrimental to capturing prey, his weight, 7.0 lbs (3.2 kg), and overall appearance indicated that he seemed to be doing well. In addition to the injuries described above he had broken the tip off his left upper canine and had damaged two claws on each forefoot while struggling in the trap.

We fitted Fisher 02 with a small 70g radio collar, allowed him to recover from immobilization and released him at his capture location. After his release, we obtained a location from upper Corral Creek on 8 December 1978 and found his collar when we attempted to locate him on foot on 9 February 1979. The collar was found beneath approximately 2" (5.1 cm) of forest litter at the bottom of a small drainage. The drainage was within a small clearcut approximately 70' (21.3 m) from the edge of an old growth conifer stand. The surrounding area was checked for evidence of Fisher 02 but none was found.

Since only three locations were obtained for Fisher 02 an individual range estimate is not reported in Table 8. However, the three locations enclosed an area of 21.9 acres (8.9 ha).

Fisher No. 01

Fisher 01, a 7.1 lb (3.2 kg) juvenile male, was captured on 9 February 1978 on lower East Hayshed Creek. He was immobilized, fitted with a 110 g radio collar and released just north of the trapsite on forest road 4N05.

On 16 February Fisher 01 was located in a Douglas-fir snag approximately 1 mi (1.6 km) southwest of his capture location. Our next contact was on 24 February when we located him north of Mud Springs, approximately 3.8 mi (6.1 km) east of his capture location. At that time he

was observed running between us as we attempted to pinpoint his location using ground telemetry. On 4 March we received a signal from upper Price Creek, but we were unable to determine an exact location.

From early March 1979 until the end of our study, on 26 June 1979, we made repeated unsuccessful attempts to locate Fisher 01 using ground and aircraft telemetry. His fate is unknown.

Fisher No. 16

This fisher, a juvenile male, was captured on 11 February 1979 on the north slope of Pattison Peak. He was immobilized in the field, fitted with a 70 g radio collar and released on the forest road below his trapsite. He showed no development of his sagittal crest and weighed 6.0 lbs (2.7 kg). His tail was docked. The injury, if it was one, occurred well before his capture.

After his release until Craig Coolahan began collecting data on him in July, we obtained 10 locations. From these data we calculate that Fisher 16 had a 5.03 mi^2 (13.03 km^2) individual range that included the northeastern portion of Pattison Peak and portions of Gates Creek to the south. The elevational range within this is 2350' (716 m) to 4900' (1494 m)

Fisher 16 may have had a larger individual range during our study than we reported. Fisher 16 and Fisher 11, another juvenile male, had radio-collars that transmitted on slightly different frequencies and were received on different parts of the same channel. During March 1979 we received a strong signal from Haypress Meadows but were unable to determine positively which fisher we were receiving although we suspect it was Fisher 16. Therefore, we did not include this location in our calculations

of individual range. Subsequent to our study Craig Coolahan has recorded several locations for Fisher 16 within the Haypress Meadows area.

Fisher No. 20

This fisher, a 4.6 lb (2.1 kg) juvenile female, was captured on 1 February 1979 near lower East Hayshed Creek at the same trapsite where Fisher 01 was captured 10 days earlier. When we first approached the trap, we noticed that the bark and litter used to cover the rear of the trap had been disturbed. This may have been done by Fisher 20 prior to her entering the trap or by another animal. She was immobilized near the trapsite, fitted with a 70 g radio collar and released.

From her release on 19 February until 26 June when Craig Coolahan began monitoring her movements, we obtained 23 locations and established her individual range at 5.33 mi^2 (13.80 km^2), the largest for any female fisher within the CBSA. Fisher 20 had an elevational range of 2750' (838 m) to 4750' (1448 m) and moved frequently over her range.

Shortly after her release, we began picking up a variable pulse rate from her transmitter. Communication with Telonics, Inc. revealed that there was probably a crack in the canister that allowed moisture to seep in and change the pulse rate. Pulse rates between 60 and 120 pulses/minute were recorded until mid-May when the pulse rate returned to normal. Craig Coolahan began monitoring the movements of Fisher 20 in July 1979.

Fisher No. 18

Fisher 18, a 10.0 lb (4.5 kg) adult male was captured on 15 March 1979 on the southwest slope of Monument Peak. He was removed from the study area and transported to Lewiston, California where immobilization

was done with personnel from the CDF&G and a blood sample was taken.

Close inspection while he was immobilized showed that both upper canines and the lower right canine were broken approximately mid-way between the gum line and the tip. His lower left canine was broken off at the gum line and the gum tissue had partially grown over the base of the tooth. He had no lower incisors and all three of his left upper incisors were missing. All his teeth except the remaining right upper incisors were tinted brown. He retained rigidity of his forelimbs throughout the immobilization. He was fitted with a 110 g radio collar, taken to Big Bar the evening of 15 March and released the following morning at his capture location.

Our next location was on 21 March, approximately 2.4 mi northwest (3.9 km) from the capture/release site. Another location was obtained on 1 April approximately 4.3 mi (6.8 km) northwest of the capture/release site in Canadian Creek. Subsequently, six additional locations were obtained, all from an area northwest of the capture/release site. His individual range as calculated from seven locations was 4.80 mi^2 (12.43 km^2) and was centered north of Chaparral Mountain on the middle portions of Mill Creek and Cedar Flat Creek. We did not use the trapsite or the location obtained on 21 March for determination of his individual range. Fisher 18, like Fisher 14, another adult male, showed movement away from his normal range during breeding season. The elevational range of Fisher 18 was between 2150' (655 m) and 4450' (1356 m).

Fisher No. 22

This fisher, a 10.1 lb (4.6 kg) adult male, was captured on

22 March 1979 on the southwest slope of Monument Peak. He was taken to Big Bar for immobilization but was not collared because we had only a single 70 g collar available and we wanted to place that on a female fisher if possible.

Fisher 22 was extremely calm prior to immobilization. Once immobilized, inspection revealed that both lower canines were broken. The tip of the left upper canine was also broken and the outside surface of the right upper canine was chipped; all were old injuries. He had a 30 mm x 25 mm area of bare skin on his left shoulder and there was a slight yellowish discharge from the penal opening. He was ear tagged and lip tatooed then released at the trapsite on 23 March at 0712.

Since Fisher 22 was not collared we have no idea where his range was centered, but we speculate it may have been near the upper end of Hayshed Creek. This area represents a "hole" where we lack data for the presence of fishers within the CBSA. We did not capture and collar any resident male fishers from this area during the study, although a small part of this area is included in the range of Fisher 10, an adult male.

Fisher No. 24

Fisher 24, an adult female weighing 3.8 lbs (1.7 kg) was the last fisher captured during our study. She was captured on 24 March 1979 at the same trapsite where Fisher 18, an adult male, was captured 9 days earlier. She was calm until approached closely and then vocalized a whistle-like "sic sic sic" repeatedly. Some of the lighter pieces of bark that covered the trap had been removed. The top of her muzzle was slightly bruised in three small spots. Inspection under immobilization revealed

revealed that her teats were prominent, indicating that she was probably in reproductive condition.

From her release on 24 March until 26 June 1979 when Craig Coolahan began monitoring her movements, we obtained 14 locations and estimated her individual range at 1.27 mi^2 (3.29 km^2). This is the smallest range for any collared fisher within the CBSA. The elevational range within this area is approximately 3100' (945 m) to 4450' (1356 m). Her range overlapped the ranges of two other fishers; Fisher 10, an adult male, and Fisher 20, a juvenile female.

Hayfork Bally Subarea

Fisher No. 08

This adult female was captured on 25 February 1978, in a small tributary of Big Bar Creek. She was instrumented with a 110 g radio transmitter collar. Ten locations were recorded for this animal. She was located once in the Price Creek drainage, but all other radio locations place her in the Big Bar Creek drainage.

Maximum distance between locations within a 24 hour period was 0.4 mi (0.64 km) and maximum distance recorded from the trapsite was 1.58 mi (2.53 km).

The lowest elevation at which this female was recorded was 2,750' (838.2 m) (14 May) and the highest elevation was 3,800' (1158.5 m) (25 February). Although only ten locations have been recorded for this animal, we have estimated her individual range to be approximately 0.86 mi^2 (2.23 km^2) This is probably a minimal estimation, as radio locations were only recorded from 25 February 1978 to 12 July 1978.

APPENDIX E (Continued).

Female Fisher 08's individual range overlapped somewhat with the individual range of male No. 09, especially during the rut (late March to early April).

From 28 June to 12 July, weak transmitter signals were received from only one location in Big Bar Creek. On 12 July, the signal was tracked down. The transmitter collar was found in an underground "den." The fisher probably removed the collar around 25 June.

Fisher No. 09

This animal, an adult male, was captured on 3 March 1978 at the same trapsite as Fisher No. 08 (a female) in the Big Bar Creek drainage. All body measurements were recorded, an ear was tagged and a lip tattooed. He was instrumented with a 110 g collar. Fifty-eight locations were recorded for this animal. Maximum distance between locations within a 24 hour period was 1.18 mi (1.9 km) and maximum distance recorded from the trapsite was 3.1 mi (5.5 km). The lowest elevation recorded for this animal was 1450' (440.1 m) and the highest elevation recorded was 4150' (1265.2 m).

Individual range for this fisher was determined to be approximately 13.2 mi^2 (34.19 km^2) and was the largest individual range recorded among all fishers. This probably represents an accurate yearly individual range. The individual range of No. 09 overlaps with that of No. 08, a female, and with that of No. 27, a male captured in the CBSA. His range was limited on the north by the Trinity River that is paralleled by US Highway 299.

Particular effort was given to recapture Fisher No. 09 during March, April and May of 1979. We had the longest continuous telemetry record for this animal and wished to reinstrument him and also to evaluate

the collar's longterm effects upon his condition. His transmitter collar had been expected to expire after 14 months in operation. It apparently did stop transmitting shortly after May 13, 1979, when the last signal was received. We used intensive live trapping and treeing first, with radio telemetry equipment alone and subsequently by using it in combination with a dog. Nothing was successful. On April 14, 15, and 22, he was tracked with ground telemetry equipment only. On two of these occasions (April 15 and 22), he moved over the Hayfork Divide from Sailor Bar Creek into Limestone Creek. He was never located in that drainage except on these two occasions. On 27 April, using ground telemetry equipment and a dog, the fisher was treed in Sailor Bar Creek. However, he treed in a large, inaccessible Douglas-fir. On 2 May 1979 , he was located by air in Big Bar Creek and on 13 May, our last data for this animal came from a location in Sailor Bar Creek.

Fisher No. 11

This immature male, weighing 6.4 lbs (2.9 kg), was captured on Hayfork Bally on 18 November 1978,and instrumented with a small (70 g) transmitter collar. An ear tag was installed, but no tatoo was applied to his lip. The animal's weight was underestimated, resulting in a light dose of immobilizing drug. Recovery from sedation was rapid and not all body measurements were taken.

We recorded 20 locations for this animal. Data were recorded from 18 November 1978 to 26 June 1979. The maximum linear distance between locations was 5.34 mi (8.5 km). Maximum linear distance from his trapsite was 4.1 mi (6.5 km). The highest and lowest elevations at

which this animal was located were 5,880' (1768 m) and 3,050' (930 m). Individual range for this fisher was estimated at 12.2 mi^2 (31.60 km^2) based on 20 locations.

Fisher No. 13

This 6.4 lb (7.9 kg) juvenile male was captured on 23 November 1978, in the Big Bar Creek, at the same capture site as No. 08, a mature female (captured 25 February 1978) and No. 09, a male (captured 3 March 1978). This fisher had broken the two middle claws of each front foot and his left upper canine tooth on the live trap, so he was taken to Humboldt State University and immobilized there on 24 November 1978. The immobilization was complete and all body measurements and other data were collected. A lip tatoo and ear tag were installed. He was instrumented with a 110 g radio transmitter collar and released back at the capture site on the same day.

Six locations were recorded for this animal. He was located once in a pile of logging debris (see Den/Rest Sites). Maximum distance between locations was 4.28 mi (6.9 km) and one of these locations was also his trapsite. The highest and lowest elevations at which this animal was located were 4,300' (1311 m) and 2,750' (838 m). Individual range for this fisher was estimated at 3.1 mi^2 (8.03 km^2) based on six locations. We feel this is an underestimation of his true range because of the low number of locations.

On 28 January 1979, his collar was found in a clearcut 4.2 mi (6.7 km) from his capture site. Approximately 2" (5.1 cm) of snow was on the ground at this time. Later in the day, when much of the snow had melted, we found the dead fisher approximately 15 yds (13.7 m) from

where the collar was found. The recovery site was in an old clearcut partially grown over with Ceanothus cordulatus. Deer bones, skin and hair were present within 50 yds (45.7 m) of the recovery site. We speculate that the fisher had been feeding on the deer carcass and was killed by a large canid, either a coyote (Canis latrans) or a domestic dog (Canis familiaris). An autopsy performed at Humboldt State University revealed massive crushing and hemorrhage of the thorax (see Autopsy Report, Appendix E).

Fisher No. 15

This 4.0 lb (1.8 kg) juvenile female was captured on 18 February 1979 in the Big Bar Creek drainage. All body measurements were recorded for this animal, an ear was tagged and the left upper lip was tattooed. She was instrumented with a 70 g radio transmitter collar.

We recorded only four locations for this animal. The maximum linear distance between locations was 1.7 mi (2.7 km) and the maximum linear distance from her trapsite was 1.5 mi (2.5 km). The highest elevation at which she was located was 4,100'. (1250 km) and the lowest was 2925' (1.55 km^2). Individual range for this animal was 0.6 mi^2 (152 ha), based on the four locations. This cannot be considered an accurate estimate of her true range.

She was found dead on 9 April 1979, at the headwaters of Big Bar Creek 1.5 air miles (2.5 km) from the capture site. She was completely submerged in a small tributary of Big Bar Creek. Airplane radio locations indicated she may have been dead since 31 March or 1 April, as these locations placed her at the recovery site. An erratic, fading telemetry signal

on 18 March indicated that she was alive and probably moving at that time. An autopsy performed at Humboldt State University revealed small minor puncture wounds about the rib cage and deep puncture wounds along the spine in the abdominal region. In our opinion, this fisher was killed by a large raptor, possibly a Great Horned Owl (Bubo virginianus). See Autopsy Report, Appendix E.

Fisher No. 17

This juvenile male weighing 6.0 lbs (2.7 kg) was captured on 10 March, 1979, in the Price Creek drainage and was recaptured on 16 March 1979, at the same trapsite. All body measurements were recorded and a tick was collected. No complications occurred during the immobilization of this fisher. He was ear tagged, his upper lip was tattooed and a 110 g radio transmitter collar was installed.

Between 10 March 1979 and 4 May 1979, we recorded 12 locations for this fisher. The greatest distance between locations was 3.6 mi (5.7 km) and the maximum linear distance from his capture site was 2.3 mi (3.6 km). Elevation at his highest location was 4,200' (1280 m) and 2,050' (626 m) at his lowest location. Individual range for this animal was 2.5 mi^2 (6.47 km^2), based on the 12 locations. Fisher 17 was located once on a limb of a 50" (197 cm) DBH Douglas-fir. We suspect this was a resting or escape tree.

On 11 May 1979, his collar was recovered at the headwaters of Corral Creek 4.7 air miles (7.6 km) from his capture site. Black bear tracks and scat were present in the same area. Upon reinvestigation the following day (12 May), the posterior cranium and lower jaw of a fisher

were found at the same location. These bones were relatively clean of skin and muscle tissue, but some dried tissue remained. We suspect the fisher had been killed during the past week which was warm and sunny. It had rained one week earlier and if the animal had been killed that week or earlier, the muscle would have rotted instead of being "jerked." See Autopsy Report, Appendix E.

Fisher No. 19

This mature, 5.4 lb (2.4 kg) female was captured on 10 March 1979 in the Price Creek drainage. After she was sedated, all body measurements were recorded, her lip was tattooed, ear tagged and a 70 g radio transmitter collar was installed. Her right upper canine had been broken off some time in the recent past, as the gum was partially healed over. Her swollen, lower abdomen and mammae made her appear to be pregnant. Locations and movements of this fisher were monitored very closely in an attempt to determine if she would establish a maternal den. None was found.

Between 10 March 1979 and the end of our radio-telemetry field work on 15 August 1979, we recorded 26 locations for this animal. Radio locations and movements of this animal continued to be monitored by Craig Coolahan until January,1980. At that time, no additional radio signals could be received. She may have been captured by a fur trapper.

The maximum distance between her locations was 2.0 mi (3.2 km), and her maximum recorded distance from trapsite was 1.3 mi (2.1 km). The highest and lowest elevations at which this fisher was located were 3,600' (1,098 m), and 2,000' (210 m). The maximum distance between her locations taken 24 hours apart was 1.1 mi (1.7 km). Individual range for this fisher was estimated at 1.6 mi^2 (4.14 km^2), based on 26 locations.

Fisher No. 21

This mature male weighing 7.7 lbs (3.5 kg) was captured on 18 March 1979 in the Price Creek drainage, at the same trapsite where No. 19, a mature female, was captured eight days previously. Body measurements were recorded and a complete examination of the animal was made. The fisher was fitted with a 110 g transmitter collar, and an ear tag and lip tattoo were installed. Location data were recorded from 18 March to 30 June 1979.

Seven locations were recorded for this animal. Steep, broken topography and deep snow on roads prevented collection of more ground telemetry data.

The maximum linear distance between locations was 5.4 mi (8.6 km) and the maximum linear distance from his trapsite was 6.1 mi (9.8 km). Elevation at his highest location was 4,000' (1220 m) and 2,100' (640 m) at the lowest elevation. Individual range for this animal was 2.3 mi^2 (5.96 km^2) based on 6 of the 7 locations. For this individual range calculation we have not used the capture site because he was probably captured during a breeding season movement. All locations except the trapsite were in the Sailor Bar Creek or the Big Creek drainages, and these areas are roughly 5.0 mi (8.0 km) and more from his capture site. However, because of the small number of locations, we feel that 2.3 mi^2 is an underestimation of his true range.

APPENDIX F

Autopsy Reports

Appendix F

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

LABORATORY REPORT

December 16, 1977

No. 238-77 Date Received 12/12/77

Collector Tim Burton

Address P. O. Box 183
Lewiston, CA 96052

Animal Fisher ♀, Martes pennanti

Remarks Specimen Entire carcass.
Found by Slader Buck. Animal had been collared and released on November 19, 1977; found dead inside log on December 9, 1977; had been rotated on neck to dorsal position. Transmitter collar appeared to have puncture marks.

RESULTS OF EXAMINATION

Animal appears in good condition, weight 4.5 pounds. Area at top of head and rump area show puncture marks with some bleeding. No other wounds found. Animal was skinned and the following puncture wounds were found.

Skull - 8-10 punctures (2 midline dorsal skull posterior to eyes, two to the rear and right side of skull, one left side to rear of eye, three left rear side, posterior portion of skull and cervical vertebrae crushed).

These wounds had penetrated the skull into the brain cavity. Bites were approximately 7/16" in width and the punctures were 1/16-1/8" diameter. The muscle on the top and each side of the skull had been ripped away from the bone. Bite wounds were also apparent in the throat area.

There was evidence of bites on the shoulders and several penetrating bite wounds were found on the rump area. It was apparent that all bites were inflicted while the animal was alive.

All the internal organs appeared normal and no gross evidence of disease was seen. No internal parasites were found.

The stomach was full and the contents were composed of a semi-liquid brown mass containing dried oak leaves, bark and debris. A number of hairs were present which

WILDLIFE DISEASE LABORATORY
GAME MANAGEMENT BRANCH

By Oscar A. Brunetti, W/L Pathologist

cc: Slader Buck

were identified as being from deer and Fisher.

This mass was composed almost entirely of fungal spores which were identified as being from a species of false truffle (Rhizopogan in the Basidiomycetes group).

Whether fungi are part of the Fisher's diet is conjectural. There was no evidence that the animal had been feeding on tree squirrels and that this was from these rodents stomachs. Was this fungi eater as a result of hunger or other adverse condition?

These spores also occurred throughout the digestive tract, it would be of interest, therefore, to take rectal samples of Fisher's trapped in the future to determine if such fungi are part of their diet.

Appendix F

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School of Natural Resources
Department of Wildlife Management

October 27, 1978

Fisher (Martes pennanti) Necropsy

Fisher #5 "Spring" is a male, estimated at being greater than 24 months of age, from the Corral Bottom study area of Trinity County. It was found dead beneath a log pile on upper Corral Creek on 7 October 1978. The total length, with the tail, was 940 mm; the length of the tail was 274 mm; the girth was 243 mm; and the head circumference was 250 mm. The total weight was 2705 g. The femurs have been kept to make a fat determination in the marrow. My general impression is that the animal looked thin at the haunches.

The skin had numerous fly maggots tentatively identified as Sarcophaga sp. Maggots were also found in the lower peritoneum and thoracic cavity. One maggot was found in a ventricle of the heart.

The stomach was empty.

There was some discoloration in both the heart and lungs. However, this could have been accounted for by the animal having been frozen. There was some discoloration on the muscle of the neck at the site of the radio collar. There was no evidence of gun shot or other trauma. There was no evidence of bacterial or other infectious diseases.

The length of time since death was not clear. An initial estimate was approximately five to seven days. My estimate on looking at the internal organs was approximately three to five days. Once the fly maggots are identified, the length of time it takes them to develop to the pupa stage can be used to establish an outside limit as to time of death.

R. G. Botzler
Associate Professor

R. G. Botzler

THE CALIFORNIA STATE UNIVERSITY AND COLLEGES

Appendix F

THE RESOURCES AGENCY OF [redacted] CALIFORNIA
DEPARTMENT OF FISH AND GAME

LABORATORY REPORT

No. 259-79 Date Received August 25, 1979

Collector Dr. Botzler
Slader Buck
Address Humboldt State University
School of Natural Resources
Wildlife Department
Arcata, CA 95521

Animal Fisher

Remarks This tissue was received in a small amount of formalin. Records on the sex and age of the animal could not be found. I believe it was a female found in a creek.

Specimen Lung, formalin fixed

RESULTS OF EXAMINATION

Lung: Although postmortem degeneration is rather extensive, the tissues are identifiable, and major organ structures are present. Homogeneous acellular material is present in most of the relatively collapsed alveoli and fills the bronchi. No bacterial process or host response is evident.

Diagnosis: Possible pulmonary edema, post mortem change.

WILDLIFE INVESTIGATIONS LABORATORY
WILDLIFE MANAGEMENT BRANCH

By David A. Jessup, DVM
David A. Jessup

HUMBOLDT STATE UNIVERSITY · Arcata, CA 95521 · (707) 826-3953

School of Natural Resources
Department of Wildlife Management

AUTOPSY REPORT

Fisher No. 13
♂, Juv.
Captured: 23 Nov. 1978. Big Bar Cr., Trinity Co.
Recovered: 28 Jan. 1979. Mud Springs, Trinity Co.

Collector: Curt Mullis. USFS/Cal. F&G/HSU Fisher Study

The animal was found lying on its side, partially covered with snow. No other fresh animal sign was evident. The animal was autopsied 31 January 1979 by Drs. R.G. Botzler and A.S. Mossman, Curt Mullis and Slader Buck.

Externally, the animal appeared in good condition, with no breaks in the skin or evidence of bleeding. Pelage was prime winter pelt. Weight of animal was 6.8 lbs. (3.06 kg), which represents a weight gain of 0.2 lbs (0.09 kg) since the time of capture (although different scales were used).

The fisher was skinned and the following wounds were found:

Rump - Minor hemorrhage and two puncture wounds in muscle.

Thorax - Massive and extensive bruises, hemorrhage and punctures in ventral half of the thorax region. Left side - at least six 'holes' through rib cage, one hole through skin, two ribs broken. Right side - seven 'holes' through ribcage. External punctures, bruises and hemorrhage on shoulder region both sides of body. Left side - moderate bruising, with single bruise 5.0 x 4.5 cm. One puncture mark at the level of the top of the scapula and 2.5 cm posterior of the posterior edge of the scapula. Right side - extensive hemorrhaging and bruising posterior to right scapula, from anterior edge of scapula to 5 cm posterior to rear edge of scapula.

Left front leg - Lateral to elbow, extensive "U-shaped" bruise, 2.5 x 3.5 cm, one puncture mark. Interior - extensive damage, three possible punctures, 2.0 cm between punctures.

Ventral neck - moderate bruise 1.5 x 1.5 cm, anterior to clavicle.

Head - Extensive hemorrhage and bruises (2.5 x 3.5 cm), posterior cranium. Puncture marks here and also 4 cm to left on posterior cranium. Also hemorrhaged and bruised (1.5 x 1.5 cm). Third bruise 6 cm behind first on right lateral neck. Bruise 1.0 x 1.0 cm.

All bites were apparently inflicted while the animal was alive as evidenced by hemorrhaging and bruising.

All internal organs appeared normal. The liver and lungs were ruptured and fragmented apparently resulting from the crushing of the thorax. No internal

parasites were found, although detailed examination was not performed at this time. The stomach was full, the contents composed mostly of deer hair and skin and a semi-liquid gray mass (deer meat?).

The fisher was recovered approximately 200 m. from a main road in the Corral Bottom Study Area. The radio transmitter collar was not on the animal, but lying on the other side of a 45 cm, burned log, about eight meters from the animal. Vegetation at the recovery site was grasses and 1.5 m. high Ceanothus. A deer scapula was found lying within 0.5 m of the collar.

It is obvious that this fisher was killed by crushing of the thorax, probably by a large carnivore such as coyote or domestic dog. The stomach was full and the animal had gained weight since being instrumented with a radio collar, indicating that it was able to efficiently forage for food.

Richard G. Botzler
Dr. R.G. Botzler

Arlin S. Mossman
Dr. A.S. Mossman

Curt Mullis
Curt Mullis

Slader Buck
Slader Buck

AUTOPSY REPORT

Fisher No. 27, adult male
Captured 11 February 1978, west of upper Corral creek, Trinity Co., CA
Recovered 17 February 1979, Price creek, below Corral Bottom road, Trinity Co., CA
Collected by Slader Buck and Curt Mullis, USFS/CDFG/HSU Fisher Study

The animal was found lying on the ground in a Douglas-fir/Live oak area. His body was among scattered rusted cans. The transmitter was functioning properly. No other animal sign was evident.

Maximum time between death and recovery (estimated via radio-telemetry) was 19 days. Estimated time between death and recovery is 7 days. Time of collection to freezing was 10 hours. The animal was autopsied on 25 July 1979 by S. Buck and Dr. R.G. Botzler at Humboldt State University.

Externally, the animal appeared in good condition. The right front foot was missing the claw on digit 5. There was no evidence of external injury and the fur was not slipping. Low ambient temperatures at the recovery site prevented rapid decomposition.

Weight of the animal was 8.2 lbs (3.9 kg), recorded with a pan scale. Weight at capture was 9.0 lbs (4.1 kg), recorded with a spring-type dairy scale.

The animal was skinned and inspected for puncture marks in the skin. None were found. The trachea contained a small amount of debris located approximately 5 cm above the bifurcation. The stomach contained small amounts of soil, small bark fragments and Douglas-fir needles. The intestines appeared bloated and contained the remains of an unidentified small mammal.

The lungs, stomach and liver showed a reddish discoloration that may have been indicative of a change that occurred prior to death. Sections of these organs were sent to the California Department of Fish and Game Wildlife Investigations Laboratory in Sacramento for examination. No abnormalities were found (pers. comm.). The animal had mesenteric fat. No parasites were found.

Exact cause of death is unknown.

Slader Buck

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School of Natural Resources
Department of Wildlife Management

9 July, 1979

AUTOPSY REPORT

Fisher No. 15, Juvenile female
Captured 18 Feb. 1979, Big Bar Creek, Trinity Co., Calif.
Recovered 9 April, 1979, Big Bar Creek
Collected by Curt Mullis, USFS/CDFG/HSU Fisher Study

The animal was found lying in a flowing creek, almost totally submerged. The radio transmitter was completely underwater and functioning properly. The location was 30 meters below a large clear cut in dense old growth Douglas fir. The creek in which the fisher was found drained out of the clear cut. No other animal sign was evident.

The foot pads had "bleached" white and the eyes were milky. Judging from this and recent radio locations, we suspect the animal had been dead at least a week and a half. The animal was autopsied on 11 April, 1979 by Curt Mullis, and Drs. A.S. Mossman and R.G. Botzler at Humboldt State University.

Externally, the animal appeared in good condition. Two small cuts appeared on the chin, within one centimeter of the incisors and approximately 0.75 mm apart. An engorged tick was removed from the top of the head, near the left ear. The fur was beginning to slough, which may be due to decomposition. However, the animal did not smell rotten and was not green.

Weight of the animal (wet) was 9.9 kg (4.5 lbs.). Weight at the time of capture was 8.8 kg (4.0 lbs.). Both weights were taken with a spring scale. The fisher was skinned and the following wounds were found:

Neck- Bruise 50X75 mm from left midline over to right midline. Moderate to severe hemorrhage. Two punctures, 2 cm apart in muscle. Skin not broken.

Right side- Bruise 50X75 mm on posterior abdomen, just anterior to hind leg. Extensive and severe hemorrhage. Small puncture through skin, near right elbow. No punctures in muscle tissue.

Left side- Five small punctures in thorax muscles; in line, approximately 2 cm apart. Area 1.0X1.0 cm punctured and severely bruised on thorax. Bruise 50X70 cm. Severe and extensive hemorrhage on left posterior abdomen, just anterior to hind leg.

Abdominal cavity- Liver with small rupture at edge of one lobe. Greater psoas (tenderloin) muscle , along ventral spine, with large puncture and bruising on left side, posterior to kidney. Unable to determine if spinal cord affected by this wound. Inflammation

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and hemorrhage also present. Lungs discolored, mottled white and pink. A sample of the lung was sent to California Department of Fish and Game's Field Station in Sacramento for patholcgical analysis. Results of that examination are attached. In summary, no pathology was present. The stomach and small intestines were partially full, but were not examined for this report. No internal parasites were found, but detailed examination was not undertaken at this time. Mesenteric fat was present.

No other pathology was found in any other organs or tissues.

Curt Mullis

Curt Mullis

Richard G Botzler

Dr. R.G. Botzler

Archie S. Mossman

Dr. A.S. Mossman

THE RESOURCES AGENCY OF SOUTHERN CALIFORNIA
DEPARTMENT OF FISH AND GAME

LABORATORY REPORT

June 21, 1979

No. N 221-79 Date Received 6/1/79

Collector Kurt Mullis
Slader Buck

Address Humboldt State University

Animal Fisher, female, immature

Remarks This tissue was taken from an immature female fisher (#15) found dead in late May of 1979.

Specimen lung preserved in formalin

RESULTS OF EXAMINATION

Microscopic Pathology:

The cross sections stain poorly due to fairly advanced autolysis. On both sections peripheral alveoli show moderate accumulation of eosinophilic acellular strands and occasional red blood cells. Bronchi unremarkable

Diagnosis: Multifocal, moderate pulmonary edema

Comment: Findings indicative of agonal and postmortem changes. No significant pathologic lesions present.

WILDLIFE INVESTIGATIONS LABORATORY
WILDLIFE MANAGEMENT BRANCH

By David A. Jessup, DVM

11-78 2M O OSP